KNOWLEDGE
AN ILLUSTRATED
MAGAZINE OF SCIENCE
PLAINLY WORDED—EXACTLY DESCRIBED

LONDON: FRIDAY, MAY 15, 1885.

CONTENTS OF No. 185.

	PAGE
Meteors and Falling Stars. By R. A. Proctor	405
The Young Electrician. (*Illus.*) By W. Slingo	406
The Philosophy of Clothing. VIII. By W. Mattieu Williams	407
Pleasant Hours with the Microscope. (*Illus.*) By H. J. Slack	408
Other Worlds than Ours	410
Tricycles in 1885. (*Illus.*)	411
Chapters on Modern Domestic Economy. (*Illus.*)	413
Evolution of the Sense of Beauty. By C. C. W. Naden	414
Firearms and Military Weapons at the Inventions Exhibition	415
First Star Lessons. (*With Map.*) By R. A. Proctor	416
George Eliot's Dog. By Robert Buchanan	416
Flight of the Buzzard	418
Editorial Gossip	419
Reviews	419
Correspondence	420
Our Mathematical Column	423
Our Inventors' Column	424
Our Whist Column	425
Our Chess Column	425

METEORS AND FALLING STARS.

BY RICHARD A. PROCTOR.

(*Continued from page* 386.)

LET it be remembered that the conditions of the problem are purely dynamical. We know that a comet's head obeys the laws of gravity, and whatever peculiarities may affect the motions of the matter of comets' tails are not by any means such as would help to render easier the captures conceived by Schiaparelli. Confining ourselves, then, to gravity, we can determine readily in what way a comet might be captured. Take the case of a particle travelling towards our solar system from out of the interstellar depths under the influence of the sun's attraction. Such a particle may be regarded as practically approaching the sun from an infinite distance,* and we know its velocity at given distances from the sun. Thus, when at the distance of Neptune its velocity would be 4·7 miles per second; at the distance of Uranus, 5·9 miles per second; of Saturn, 8·3 miles; of Jupiter, 11·4 miles; of the asteroids, from 15 to 16 miles per second; and the velocity in crossing the distances of Mars, the Earth, Venus, and Mercury, would be 20·8 miles, 25·9, 30·3, and 41·4 miles per second respectively. Now we know that the greatest velocity which any given planet can communicate to a body approaching it under its sole influence from interstellar space, is very much less than the velocity which such planet can communicate to a body approaching it under the sun's influence in addition to its own. For the communication of velocity to a moving body is a process requiring time, and in the latter of the two cases just considered the body is for a much smaller time under the influence of the planet.* And the velocity which a planet can communicate under any circumstances represents the velocity which, under similar circumstances, the planet can withdraw from a moving body. So that Jupiter, Saturn, Uranus, and Neptune are severally unable to deprive a particle which, drawn in by the sun's attraction, passes near to them, of more than a portion of the velocity which these planets are respectively able to communicate to a body approaching them from infinite space. Taking, for example, the case of Jupiter, we may regard 38 miles per second as a sort of negative fund from which Jupiter would have the power of drawing, to reduce the velocity of bodies moving from him, if Jupiter were the sole attracting influence under which such bodies had acquired their velocity; *but* in the case of bodies which have been drawn inwards by the sun's attraction, the fund is reduced to about 28 miles per second. Now this might seem ample when we remember that the velocity of a body crossing the path of Jupiter under the sun's influence alone would be but 11·4 miles per second. But it is to be observed that the estimate only applies to bodies moving all but directly from Jupiter, and coming all but into contact with his surface. The power of Jupiter in this respect diminishes rapidly with distance from the surface. At a distance from Jupiter's centre equal to four times his radius, his power is already diminished one-half, and this distance is far within that of even his nearest satellite. Moreover, it is to be noticed that a body which moves in such sort that Jupiter exerts his most powerful retardative influence, must have moved for some time previously in such a way that Jupiter exerted nearly his most powerful accelerative influence.† It may be readily shown to be impossible for Jupiter to withdraw much more velocity than he had already communicated; and similar remarks apply, of course, to Saturn, Uranus, and Neptune.

(*To be continued.*)

* The point considered is the velocity of the particle at given distances from the sun; and the estimated velocity is appreciably the same whether the particle be supposed to come from the distance of the nearest star or from an infinite distance. This is easily seen from the formula

$$V^2 = v^2\left(2 - \frac{r}{a}\right)$$

where r represents the radius of a circular orbit described with velocity v, and V is the velocity at distance r, of a body travelling in an orbit having mean distance a. For, regarding the earth's orbit as unity, put

r = earth's distance = unity,
v = earth's velocity = 18·3.

taking a mile as the unit of length, and a second as the unit of time; (though we have put r = unity, this does not force us to take r as our unit of length, because we only require to consider the ratio in what follows). Then we have—

$$V = 18{\cdot}3\sqrt{2}\sqrt{1 - \frac{1}{2a}} = 25{\cdot}9\left\{1 - \frac{1}{4a} - \frac{1}{32a^2} - \&c.\right\} = 25{\cdot}9,$$

if a is made infinite. But if a be taken equal to half the distance of Alpha Centauri, say = 100,000, we have

$$V = 25{\cdot}9 - 0{\cdot}00006475 - 0{\cdot}000000000809375 - \text{smaller terms},$$

all the terms after the first being together manifestly less than 0·00007, or about 4½ inches. In other words, whereas a body approaching the sun from infinity would have a velocity of about 25·9 miles per second, a body approaching the sun from the distance of Alpha Centauri, so that its mean distance may be regarded as half the distance of that star, would have a velocity less by 4¼ inches per second, a difference so small that it may be regarded as evanescent. It is a curious consideration, however, that minute though such differences are when we are merely comparing velocities, yet distances due to such differences in the enormous time-intervals which the study of comets introduces to our consideration, are to be measured by thousands of miles.

* See the accompanying papers on the "Mathematics of Meteoric Motion."

† It is manifest that a particle in approaching from without must be, in the first instance, accelerated by any planet to which it draws near, no matter what the direction may be in which the particle arrives. It may begin to be retarded, however, before it has reached the distance from the sun at which the disturbing planet is travelling. In any discussion of the change of path as to position, we should need to inquire very carefully into the manner of approach; but in the above discussion we are only inquiring into the change of velocity.

THE YOUNG ELECTRICIAN.

By W. Slingo.

(*Continued from p. 345.*)

DIES.

Ex. LI.—A few words were said a fortnight since on dies when referring to small die-stocks, but something further is necessary. Fig. 24 represents, as then stated, the plan (A B) and elevation (C D) of a pair of dies. Those here shown belong to what is known as the Whitworth screw-cutting tackle. The principles involved in them are identical with those pertaining to the small dies fitting into the small die-stock (Fig. 23). A pair of dies in reality act in a similar way to the hole in a good screw-plate, such as that illustrated in Fig. 19. The dies are intended, however, for work too heavy to be performed by a screw-plate. There is also a most important advantage inherent in the dies, viz., that the thread is produced gradually, or by a succession of varying cuts, instead of being produced by a single thrust through the plate. This gradual formation of the screw is obtained by variations in the adjustment of the thumb-screw, so as to bring the dies closer together at each adjustment.

A little amplification is, perhaps, necessary to simplify the matter. When it is intended to cut a screw with the aid of the dies and stock, the movable die is drawn sufficiently far from the stationary one to allow the lower portion of the work to be placed between them. The movable die is then screwed up until a small indentation is made on the metal by the die threads. The metal is then screwed down through a distance equal to the length of the intended screw (or the metal may be held in a vice, &c., and the die-stock revolved). In this way a portion of the thread is formed. To increase its depth, set the thumb-screw a little further forward and then turn the metal (or die-stock) backwards through the length of the screw. The other end being reached, repeat the operation, and continue the series of cuttings until the requisite depth is attained.

This gradual or step-by-step production of the thread insures the manufacture of a screw, the pitch of which corresponds with something approaching to accuracy to the pitch of the thread on the dies from which it is cut. A second advantage possessed by dies over a screw-plate is, that in the event of the tap used to make the female thread, into which the to-be-made screw is to fit, being partially worn or by some other means rendered a trifle smaller than it should be, the dies may be so adjusted as to produce a screw proportionately smaller than the normal size. This will sometimes be found to be an important feature. It is, thirdly, noteworthy that when a screw is made by a single thrust, as in the screw-plate, there is a tendency to elongation on the part of the metal, resulting in an increase in the pitch.

Now for the dies themselves. In Fig. 24 the plans B and A are stamped with the figures 1 and 2 respectively, showing the relative positions which they should hold in the stock—that is to say, No. 2 should be the movable die actuated by the thumbscrew. Whatever the figures may be, the higher one should always be the adjustable die. These figures, moreover, are placed on one side of the upper face of the die, and corresponding figures are stamped along the face of one side of the stock. The object of this is to indicate the right way to insert the dies. The figures on them should be on the same side and on the same face as those on the stock. This is most important, for, if not carried out, the dies will not match and a screw cannot be formed.

The construction of the dies may be gathered from the illustrations, *a a a* being the cutting edges, the spaces between affording ready means for the escape of the cuttings. The peculiarities of the threads we can deal with presently. It may, however, be observed that the dies are cut from a master-tap which is larger in diameter than the screw to be cut by them, the difference being equal to the depth of the threads. It is important that we should understand the reason of this. Were the thread on the dies *equal* in diameter to that on the intended screw, it will be apparent that the smaller diameter of the dies (or the distance between two opposed *a*, *a*, Fig. 24) would be less than the diameter of the metal to be cut, seeing that that diameter is equal to the diameter at the *bottom* of the die-threads. Now prior to any cut being made upon the surface of the

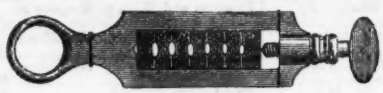


Fig. 23.

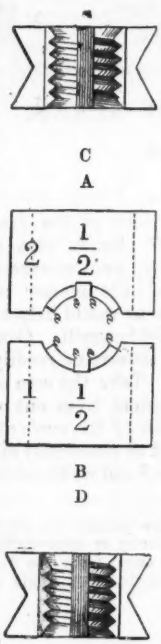


Fig. 24.

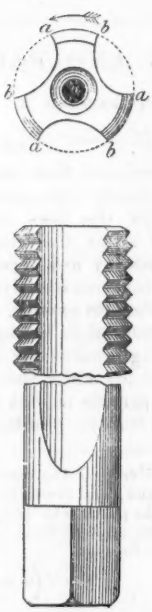


Fig. 26.

Fig. 25.

metal, the approach of the dies to it will result in their only touching it at the two corners of the cutting-edges on each die. To make this clearer (in an exaggerated sense) we may suppose a semi-circle of 1 inch diameter to approach a circle of 1½ inches diameter. It is evident that the semi-circle can only touch the circle at its two extreme points. The effect of such an arrangement, were it applied to dies, would be that the corners of the cutting-edges would have far too great a strain upon them, and would soon be broken.

WHITWORTH STOCK.

Ex. LII.—This stock, which is illustrated in Fig. 25, is used when heavy work has to be done. It is rarely used for screws less than a quarter of an inch in diameter, the threads being coarser than those with which the dies used in the small stock (Fig. 23) are provided. The frame is

constructed to hold only a single pair of dies of the form shown in Fig. 24. An extra piece of metal is usually placed between the dies and the screw to save wear upon the die. The adjusting screw is placed at the side instead of being used as a handle—the handles being long and rigid, and permitting a considerable amount of force to be applied.

WHITWORTH TAPS.

Ex. LIII.—In Fig. 26 is an enlarged illustration of a Whitworth tap, the threads of which are cut at an angle of 55°, rounded at the top and bottom, the curve having a diameter equal to one-sixth the depth of the thread. The cutting edges are produced by a species of flute illustrated by the sectional view. It will be noticed that the cutting edges *a a a* are evolved from a shorter radius than *b b b*. The smooth upper portion has a diameter a trifle less than that of the bottom of the thread, thereby enabling the tap, when used in a plate of metal, to fall through on the lower side, and so saving the trouble of screwing it back. The head or shank is generally square. When the thread of the tap is of uniform diameter throughout it is known as a "plug" tap.

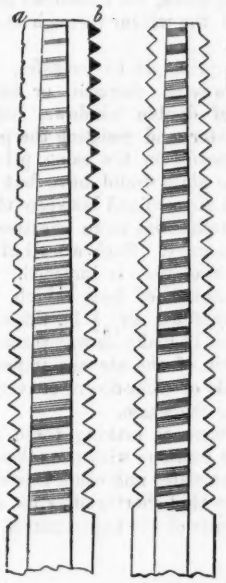


Fig. 27.

Fig. 28.

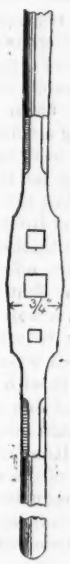


Fig. 29.

Ex. LIV.—Fig. 27 illustrates a "taper" tap, which is first made as a plug tap, the lower portion or point of which is tapered down as shown at *a*, the amount of metal removed being indicated by the dark threads *b*. The object is that the point of the tap being of the same size as the hole it is to thread, may immediately and readily effect an entrance and at the same time cause a gradual removal of the metal, the *forming* of the threads being entrusted to the upper portion of the tap. The diameter, at least near the entrance, being now of full dimensions, the plug tap can be introduced and the thread made parallel throughout.

Ex. LV.—Fig. 28 illustrates a form of taper tap, not to be recommended, as the threads formed at the entrance by the point of the tap are only slight grooves, cut by the extreme edges of the thread. The amount of metal removed is very small, when compared with the work performed by the taper tap, illustrated in Fig. 27. It is further noticeable that the edges of the threads near the point, having the bulk of the work to get through, soon break away, until they approach the appearance of the better form of tap.

TAP WRENCH.

Ex. LVI.—The tap-wrench is illustrated in Fig. 29. It is a flat piece of case-hardened iron with round handles, and provided with a number of square holes of various sizes, into which the heads of the taps are placed, when the process of tapping is to be proceeded with. The use of this tool is too obvious to call for further remark.

THE PHILOSOPHY OF CLOTHING.

By W. Mattieu Williams.

VIII.—THE TRANSMISSION OF HEAT THROUGH CLOTHING.

THE fact that so small a quantity of fibrous material mixed with the air in the globe of the passage thermometer should bring down its conducting power so remarkably (see experiments 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10, page 322)—$\frac{1}{55}$ of the volume of raw silk increasing the time of cooling from 576 to 1,284 seconds—was not to be passed over as a matter of course, simply because it was a fact, by such a man as Rumford. He saw at once that it indicated something that yet remained unexplained, and therefore that further research was demanded; a research which led him to most important discoveries in the laws of the propagation of heat.

Referring to the articles on Heat in the Cyclopædia of Chambers and Rees, published 1789 (about simultaneously with these experiments), also to the third edition of "The Encyclopædia Britannica," 1797, and to that of Croker, Williams, and Clark, 1764 (an excellent work, supplying the others with a multitude of verbatim paragraphs), I find that the propagation or communication of heat was then sadly neglected, although the nature and origin of heat were keenly discussed. The difference between the conduction and conversion of heat, upon which so much in the economy of nature depends, was not at all understood. Therefore, Rumford had to work it out for himself. I am treating this part of the subject rather fully, as it constitutes the fundamental basis of the Philosophy of Clothing, and it is very interesting to follow the route by which Rumford made his important discoveries.

They present an interesting instance of how a logical effort to apply pure science to practical business may react in such a manner, that practical business shall become a beneficent contributor to pure science. The boring of brass-cannon suggested Rumford's celebrated demonstration of the principle that "heat is motion," and in like manner the selection of the best material for soldiers' coats and trousers led him to discover the convection of heat.

Assuming, in accordance with the science of the period, that the heat which passed from the bulb of his thermometer through the matter surrounding it was transmitted by conduction, the problem suggested by the above stated facts was, as he says, "How does air conduct heat?" and "How can air be prevented from conducting heat?" He says: "If air conducted heat, as it is probable that the metals and water and all other solid bodies and inelastic fluids conduct it, that is to say, if its particles remaining in their places, the heat passed from one particle to another, through the whole mass—as there is no reason to suppose that the propagation of heat is necessarily in right lines—I cannot conceive how the interposition of so small a quantity of any solid as 1-55 part of the volume of the

air could have effected so remarkable a diminution of the conducting power of the air."

The following is one of the experiments he made in attacking this problem. He took a cylindrical clear glass bottle, about 8 inches in diameter and 12 inches high, with a short and narrow neck, suspended in the middle of this a small piece of wetted linen rag; then plunged the bottle in a vessel of water at about 100° Fahr. It remained there until the contents of the bottle were not only heated, but thoroughly saturated with moisture by evaporation from the rag. The cork was then taken out, the rag removed, the bottle recorked immediately, and then plunged into clear ice-cold water contained in a cylindrical glass jar. The apparatus being placed in a good light, careful observations were made.

The air in the bottle, being saturated with vapour of water, it could not be cooled in any part without, "*at the same moment and in the same place*, parting with some of its water"; therefore, if the heat passed out from the air in the bottle by penetrating the mass from the centre to the surface by conduction from particle to particle, the greater part of the air in the bottle would part with its heat when not actually in contact with the glass, and a proportional part of its water being let fall at the same time and in the same place, would necessarily descend as fine rain, probably invisible as rain, or as drops of water on the bottom of the bottle, but would at least be visible as "that kind of cloudy covering which cold glass acquires from contact with hot steam or watery vapour; but if the particles of air, instead of communicating their heat from one to another, from the centre to the surface of the bottle, each in its turn and for itself, came to the surface of the bottle, and there deposited its heat and its water," he concluded that the amount of condensation on the sides of the bottle should be as great as on the bottom, or even greater.

He found this to be the case, and further that it made its first appearance upon the sides and near the top of the bottle, and gradually spread downwards, "till growing fainter as it descended lower, it was hardly visible at the distance of half-an-inch from the bottom of the bottle; and upon the bottom itself, which was nearly flat, there was scarcely the smallest appearance of cloudiness."

Rumford's explanation of this is the same as is now universally accepted, viz., that the particles or film of air in contact with the glass is cooled, and deposits there some of its moisture; then, in consequence of its increased specific gravity, it slides downwards by the sides of the bottle to the bottom, where it takes its place and forces the whole mass of warmer air upwards. This upper warm air is cooled and descends in like manner, the deposition and circulation continuing until all is cooled down to the temperature of the surrounding water; the upper part being always the warmer during the action, more water is deposited on the upper part of the sides of the bottle.

Rumford's conclusion from this and other experiments was that "though the particles of air, individually or each for itself, are capable of receiving and *transporting* heat, yet air in a quiescent state, or as a fluid whose parts are at rest with respect to each other, is not capable of conducting it or giving it a passage; in short, that heat is incapable of *passing through a mass of air*, penetrating from one particle of it to another."

Here, then, we have an explanation of the mystery above stated. The fine fibres distributed loosely through the air in the globe of the passage thermometer prevented free circulation of the air, for although so small a quantity, even if absolutely non-conducting, could have had but little effect in preventing the air from "giving a passage to the heat" itself, it might, and must, very much interfere with that circulation of the air which is necessary for the transmission of heat by the "transporting" action (as Rumford then called it) of the travelling particles, *i.e.*, by what we now call "convection currents."

Here, then, we have the first step towards an explanation of the protective power of the fur and feathers of animals and the artificial clothing of man. Air, as Rumford then contended, and as now is fully proved, is almost, if not quite, a non-conductor of heat. Heat cannot pass through air in the same way as it passes through metals, but may be conveyed by the movements of the air itself. The effective clothing agent is the non-conducting layer or outer skin of air which envelopes our bodies and is held in its place by the fibres of the clothing. The formation of convection currents being impeded, we obtain the protective benefit of this non-conducting (or ill-conducting) skin of entangled or imprisoned air.

This is not only the case with the clothing of animals, but also with the winter clothing of the earth. The feathery crystals of ice of which snow is composed imprison a layer of air many times greater in bulk than themselves, and thus in climates where the winter temperature of the air falls greatly below the freezing-point, the snow-clad ground and its vegetation remain all the winter through at about the freezing-point.

We now apply the same principle to ice-safes, which have double walls with powdered charcoal or sawdust between them. The use of double windows, both for retaining artificial heat in winter and resisting the passage of outer heat in summer, depends on the same principle. Doubling the thickness of the glass would have but small effect; but the thick layer of air confined between them is (if shaded from direct solar radiation) more effective than an equal thickness of solid masonry. Such a wall of air is still more effective if its circulation is impeded. Thus Rumford found that an amount of heat which passed through a wall or sheet of confined air, $\frac{1}{2}$ in. thick, in $9\frac{1}{5}$ minutes, required $21\frac{2}{5}$ minutes to make its way through the same wall when the circulation of the air was impeded by mixing it with $\frac{1}{60}$ of its bulk of elder-down, or very fine fur, or of fine silk as spun by the worm.

I should add that, at the time of making these experiments, Rumford supposed, in common with the other philosophers of the same date, that water and other liquids were good conductors of heat, but that shortly after he refuted this by following up the results of his experiments on the transmission of heat by air.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

In Knowledge for March 20 reference was made to Carter's box of seeds for the microscope, and some of the most interesting from the Composite family were described. The beauty and curiosity of seeds under the microscope depends chiefly upon their integuments and appendages. Their minute anatomy and physiology are important and interesting studies, but we shall now consider only their external aspects.

Amongst the Umbelliferæ, carrot-seed will be found to be of oval shape, decorated with longitudinal ribs and projecting spines. Carraway-seeds are rich brown in colour, with lighter ribs and no spines. The Spanish Balm (*Anethum*) has also a ribbed seed, slightly hollowed like a boat. Amongst the Scrophularians, which comprehend

snapdragons, veronicas, foxgloves, and a great many more of our prettiest wild and cultivated plants, several afford seeds worth notice. The garden *Antirrhinum* has small, dark, roundish, deeply-pitted seeds. Foxglove (*Digitalis*) has very small seeds, paler brown, somewhat oblong, and very finely marked. *Linaria* seeds are very small, black, with transverse raised bands, spotted over with glittering dots. Another species (*Perezi*) present quite another aspect, being rather larger, and the germinating part contained in a little flat bag, with a rim round it. It is covered with minute projections. Evening Bride (*Nyctícina*) seeds differ again, being like minute lumps of jujube, pitted in drying.

Nigella hispanica, which belongs to the Ranunculus, or Buttercup family, has its seeds in the shape of plump black bags about one-sixteenth of an inch long, elegantly marked with longitudinal and also transverse ribs, forming a network.

Amongst the Pink family seeds of *Dianthus barbatus* may be noticed as flattish, shrivelled black bags abundantly decorated with hundreds of minute furrows and tubercles. The garden Lychnis (Ragged Robin) has somewhat kidney-shaped seeds, with numerous rows of tubercles.

increases the perspective effect for those who have tolerably well-paired eyes. In all cases where a given magnification is required for an irregular object, with parts in different planes, it will be found better to use a lower power and a B eye-piece, than a higher one and an A eye-piece. The former arrangement gives much more penetration.

A sufficient study of the structure of the coverings and appendages of seeds would, no doubt, show an adaptation to the wants of the plant germs. A thick integment must afford more protection than a thin one. A rough one may, besides getting a firmer hold of the ground, be absorbent of moisture, and prevent that rapid drying up which a smooth-coated seed might suffer. Appendages favouring dispersion are readily recognised, and their use is obvious; but the elaborate lace-work of the Paulownia, and similarly-provided seeds, is not so easily referred to the standard of utility, though it is probably only want of knowledge that prevents its comprehension. The *Micrographic Dictionary* mentions, under the head of seeds of special interest, several not in Carter's list, and for mounting in Canada Balsam specifies Parnassia, Drosera, Orchis, Pyrola, Saxifraga, Monotropa, Hydrangea, Rhododendron.

Besides looking at seeds as wholes with low powers their

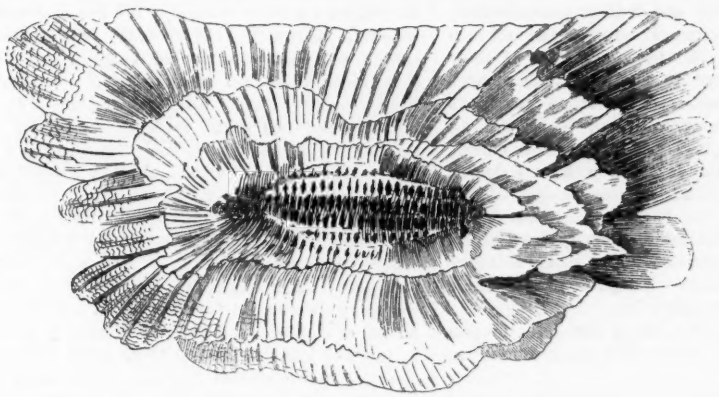


Fig. 1.—Paulownia imperialis seed (×30).

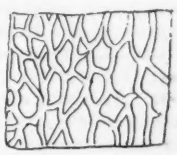


Fig. 2.—Portion of the fringe enlarged (×150).

Escholtzia tenuifolia seeds are about one-sixteenth of an inch in diameter, roundish, and very rugged, looking, under the microscope, like one of the deeply-fissured corals.

White Poppy seed is whitish, translucent, and elegantly reticulated. Mountain sylph, a garden gentian, exhibits a series of bands with furrows and markings, giving it somewhat the aspect of a maize cob.

Calampelis seeds are like black bags, with a light lace fringe. *Paulownia imperialis* seeds afford remarkably beautiful specimens of this lace-work decoration, as shown in the appended sketch, but a very much finer engraving would be required to do it justice.

It would be tedious to run through a longer list. About half the specimens in Carter's 100 kind box possess considerable beauty, and a good many of the others are of interest for the sake of comparison. They are sent out in little round wooden boxes, and a handy plan of preparing them for view under the microscope is to put a drop of gum inside the lids of the boxes a let a few of the seeds stick in it, of course, avoiding using enough of the liquid to soil the upper surfaces.

Most of the seeds can be well shown with a 3-inch objective and B eye-piece, and they look best in strong lamplight, which can be thrown on them by a bull's-eye, or, better, with a silver reflector. A binocular instrument hairs, lace-work appendages, and often the cell-structure of their integuments should be separated and viewed with more magnification. Polarised light is often effective with hairs, but the lace-work of Paulownia does not act sufficiently upon it.

The custom of sowing so many seeds in the course of agriculture and gardening tends to draw attention from the fact that the great majority of plants have to take care of their own offspring, and those would soon fail whose seeds could not successfully perform their part in the great life-struggle. When studying the character of seed appendages and integuments regard should be had to the various difficulties in the way of their getting fixed in suitable places and escaping the notice or the attacks of their enemies. The farmer and the gardener put their seeds in clean, clear ground, and carefully cover them up. Wild seeds have no such care taken of them, and a great many wild plants, instead of gaining by such artificial attentions, perish under them.

The subjoined list comprehends the most interesting in Carter's collection. The seeds are all sterilised to stop sprouting, so they are useless for propagation.

Carrot, Calliopsis, Tagetes, Acroclinium (Sand Rose), Arctotis (Golden Wheel), Amblyolepis, Calliopsis coronata, Centaurea, Cyanus major and minor, Palafoxia, Pyrethrum, Sauvitalia

Waitzia, Nigella, Hyoscyamus, Oxalis rosea, Scyphanthus, Papaver album and ceruleum, Pampas Grass, Digitalis, Carraway, Silene pendula, Gladiolus, Lychnis, Calampelis, Petunia, Eucharidium concinnum, Gentian, Paulownia imperialis, Whillatia, Reveda, Dianthus barbatus, Linaria Anagalis, Amaranthus, Silene armeria, Loasa aurantiaca, Nemesia Portulaca, Lophospernum, Escholtzia crocea and tenuifolia.

The Umbellifers are put first. All are worth examining, though not half have special beauty. The others are given without any botanical or other classification. As stated in the former article, the Composites, which are well represented in the collection, deserve special attention.

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

THE SIXTH EVENING (*continued from p. 370*).

"THE entire resemblance of the planets with the earth," I continued, "which is inhabited, the impossibility of conceiving any other use for which they were created, the fecundity and magnificence of nature, the certain regards she seems to have had to the necessities of their inhabitants, as in giving moons to those planets remote from the sun, and more moons still to those yet more remote; and what is still very material, there are all things to be said on one side, and nothing on the other; and you cannot comprehend the least subject for a doubt, unless you will take the eyes and understanding of the vulgar. In short, supposing that these inhabitants of the planets really exist, they could not declare themselves by more marks, or marks more sensible; and after this you are to consider whether you are willing not to take their case to be more than purely probable."

"But you would not have me," says she, "look upon this to be as certain as that there was such a man as Alexander?"

"Not altogether, madam," says I; "for tho' we have as many proofs touching the inhabitants of the planets as we can have in the situation we are, yet the number of these proofs is not great."

"I must renounce these planetary inhabitants," said her Ladyship, interrupting me, "for I cannot conceive how to rank them in my imagination; there is no absolute certainty of them, and yet there is more than a probability; so that I am confounded in my notions."

"Ah, madam," says I, "never put yourself out of conceit with them for that; the most common and ordinary clocks shew the hours, but those are wrought with more art and nicety which shew the minutes. Just so your ordinary capacities are sensible of the difference betwixt a simple probability, and an evident certainty; but it is only your fine spirits that discern the exact proportions of certainty or probability, and can mark, if I may use the phrase, the minutes in their sentiments. Now place the inhabitants of the planets a little below Alexander; yet above many other historical facts which are not so clearly proved: I believe this position will do."

"I love order," says she, "and you oblige me in thus ranging my ideas for me; but, pray, why did not you take this care before?"

"B-cause," says I, "should you believe the inhabitants of the planets either a little more or less than they deserve, there will be no great damage in it. I am sure that you do not believe the motion of the earth so fully as it ought to be believed; and have you much reason to complain on that score?"

"Oh, for that matter," replies she, "I have discharged myself very well; you have nothing to reproach me with on that account, for I firmly believe that the earth turns."

"And yet," says I, "madam, I have not given you the strongest reasons in proving it."

"Ah, traytor!" she cried, "to make me believe things upon feeble proofs! Then you did not think me worthy of believing upon substantial reasons?"

"I only proved things," says I, "upon little plausible reasons, and such as were adapted to your peculiar use. Should I have conjured up as strong and solid arguments, as if I had been to attack a doctor in the science?"

"Yes," says she; "pray take me for a doctor from this moment, and let me have your full demonstrations of the earth's moving."

"With all my heart, madam," says I, "and I own the proof pleases me strangely, perhaps because I think it was of my own finding; yet it is so good and natural that I must not presume positively to have been the inventor of it. It is most certain that, if a learned man was puzzled, and desired to make replications to it, he would be obliged to declaim at large, which is the only method in the world to confound a learned man. We must grant that all the celestial bodies in twenty-four hours, turn round the earth, or that the earth turning on itself, imparts this motion to all the celestial bodies. But that they really have this revolution in twenty-four hours round the earth is a matter which has the least probability in the world, tho' the absurdity does not presently appear to our view. All the planets certainly make their great revolution about the sun; but these revolutions of theirs are unequal, according to the distances of the respective planets from the sun; for the most remote ones make their course in a longer time, which is most agreeable to nature. The same order is observed among the little secondary planets in turning about a great one. The four moons of Jupiter, and the five of Saturn, make their circles in more or less time round their great planet, according as they are more or less remote. Besides, it is certain that the planets have motions upon their own centers, and these motions likewise are unequal. We cannot well tell how to account for this inequality—whether it proceeds from the different magnitudes of the planets, or on the different swiftness of the particular vortexes which inclose them, and the liquid matters in which they are sustained; but, in short, the inequality is most undoubted; and such is the order of nature in general, that whatever is common to many things, is found at the same time to vary in some different particulars."

"I understand you," says the Marchioness, interrupting me, "and I think there is a great deal of reason in what you say. I am entirely of your mind, if the planets turned about the earth, they would do it in unequal spaces of time, according to their distances, as they do about the sun. Is not that the meaning of what you were saying?"

"Exactly, madam," says I; "their unequal distances with respect to the earth, their different magnitudes, and the different rapidity of the particular vortexes inclosing them, should consequently produce differences in their pretended motion round the earth, as well as in all their other motions. And the fixed stars, which are at such a prodigious distance from us, and so much elevated above everything that can take a general motion round us—at least which are situated in a place whence this motion should be very much weakened, would there not be a very great probability that they did not turn at all about us in twenty-four

hours, as the moon does who is so near us? And should not comets, which are strangers in our vortex, and which run courses so different one from the other, and with such unequal rapidity, be excused from turning round us in the same space of twenty-four hours? But no matter, fixed stars, and comets, and all must turn round the earth in twenty-four hours; yet, if there were some minutes' difference in these motions, we might be contented; and they all must make them with the most exact equality, or rather the only exact equality which is in the world, and not one minute more or less allowed.* In reality, this matter is strangely to be suspected."

"O!" says the lady, "since it is possible that this grand equality should be only in our imagination, I am intirely convinced it is derived only from thence. I am very well pleased, that any position, which is against the genius of Nature, should fall entirely upon ourselves, and that she should stand discharged, tho' at our expence."

(To be continued.)

TRICYCLES IN 1885.

By JOHN BROWNING.

(Chairman of the London Tricycle Club.)

A TRICYCLE RIDE.

ONE morning towards the end of last autumn I started for a day's tricycle ride. Mr. Arthur Salmon, one of the best riders in my club, accompanied me. We started together from Reigate Hill at seven minutes past six in the morning, at which time it was only just beginning to get fairly light.

As we ran through Reigate, the little market-place of the town looked very pretty with the sun rising on it through a slight mist. I can remember Reigate for nearly thirty years, and I do not know any town which has been so little injured by alterations in that space of time. We saw in the roads only a few men going to work. The town itself looked asleep. Riding easily up the Woodhatch Hill and swiftly down the further side, we quickly found ourselves crossing Earlswood Common. The morning was cool, with a strongish wind blowing from the north-east. This was somewhat a cross wind, but still considerably in our favour on the whole. Cattle were seen grazing on the common through the mist, which, say what we will about our climate, gives atmospheric effects which are the greatest charm of an English landscape.

Finding the ironstone road in very perfect condition, I expressed a wish that my machine could be geared up higher. "Shorten your pedals," said my ready companion; and together, in a minute or two, we shortened them to $4\frac{1}{2}$ in. The effect was so pleasing, that very soon I shortened them as much as possible to $4\frac{1}{4}$ in., at which length of crank I have ridden ever since, even on a machine geared 6 in. higher than I was then riding.

In less than an hour from the time of our starting we had passed through the long, straggling village of Crawley, and under the sign of the old coaching house, "The George," whose sign-board spans the road, and turning sharp round by the side of this hotel, we were in a narrow way which a stranger would suppose to be a bye-street of the village, but is really the main road, through Horsham to Worthing.

From Crawley to Horsham, our road ran through St. Leonard's Forest. The greater part of the distance it was strongly undulating, with a beautiful surface, neither muddy nor dusty, and being made of a very rich ironstone, its colour was a deep red, which contrasted finely with the thick foliage on either side. As the sun was now getting through the mist, the shade was delightful, and we were soon gliding along Roughey-street, surely badly named, for it is an unusually smooth road, running, for the last mile or more, mostly down hill, from Maplehurst into Horsham.

As we entered the old town, a few tradesmen were taking down their shutters. We passed across a broad green into a moderately wide street, and then found that we should have taken a narrow one, the broad street leading out of the town, not into it. The plan of Horsham is so ingenious that, although I have been there about twenty times, I often make a mistake in passing through it.

We reached Horsham at 8.6 a.m., having been just about 1 hour and 48 minutes, allowing 11 minutes for stoppages, in riding the seventeen miles from Reigate Hill.

Breakfast was ordered, and while it was being got ready we went out and bought as many large peaches as we could stow away in our wallets.

After breakfasting leisurely, we left Horsham at 8.38, taking the main road to Worthing. From Horsham we went over a hilly road, through Southwater, to West Grinstead, though we saw little of this village, as the principal part of it lies just off the main road.

Again, we rode on from West Grinstead, through Dial Post and Ashington, to Washington Common, and here we encountered the long steep hill which goes over the Downs. Up this we rode—on my own part, though, assisted by my hill-gearing, with difficulty. When we had reached the top, we thought we deserved our peaches. I should think it is very seldom indeed that peaches are so delicious as ours were.

As we were ascending the steep hill on our left, right above us lay Chanctonbury Ring, an old entrenchment, in a most commanding position, surmounted by a fine clump of trees, which can be easily seen on any fine day from Reigate, a distance of upwards of thirty miles. While we were riding up the hill, some farmers, who passed us in gigs, offered to assist us. To their evident surprise, we overtook them, said a few words to them, and then bade them good-bye. On a broad, loose road in this locality, I said to my companion, "Arthur, I think the other side of the road is the best." "Oh, it's no use changing for that," he replied; "whichever side of the road you happen to be riding on, the other side is always the best."

Next we passed through Finden and Broadwater, over a good road, mostly down hill, and rolling rapidly along the High-street, our feet on the rests the greater part of the way, we were soon at the pier of pretty little Worthing.

Our time of arrival being 11.20, we found we had taken rather more than two and three-quarter hours to ride the twenty miles from Horsham. This was the slowest part of our journey, but it was one continual succession of hills, culminating in the steep climb over the South Downs.

After a walk along the esplanade, through and round the town, we had an excellent dinner of cold meats, tomatoes, &c., at the Steyne Hotel, which I can strongly recommend.

Having been one hour and ten minutes in the town, we started again at 12.30, and rode on through Broadwater, Hangleton, and Preston, about thirteen miles to Littlehampton. This was about twelve miles of excellent road; but, being desirous of getting another glimpse of the sea, we found ourselves on the sea-beach, and had to ride about a mile into Littlehampton, over shingle. Then we rode up from the beach, which is about half a mile from the town, through the High-street, past the queer old Brewery, which resembles a wooden building on a Thames

* He might have said "not one-tenth of a second."—R. P.

wharf, and is the principal architectural feature of the place, through the town to the railway station, from whence I telegraphed home, and from there on to the chain ferry. Crossing by this ferry over a narrow creek of the sea, which is the mouth of the river Arun, the air felt iced, after the heat and exercise on the land. We had landed and ridden at least a quarter of a mile over shingle, when we heard some one calling behind us, and, looking round, we saw one of the ferrymen running after us. To save time, we rode back to him, and discovered that the calculation of the charge for carrying ourselves and our tricycles had been too much for him, and that he had asked threepence too little. This sum I gave him, and, together with it, mentally, my blessing; for the delay in taking my telegram, which could not be received until a train was despatched, and the stoppage and crossing this ferry, not a hundred yards wide, had hindered us half an hour.

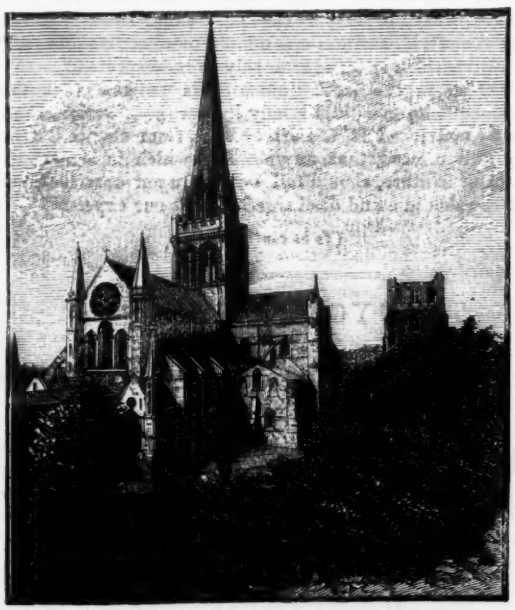
Riding on again, we caught up with and passed a man on horseback, who had crossed with his horse in the same ferry-boat with us, and then we came upon a mile or two of road loosely strewn with shingle, each stone being round, smooth, and quite unbroken. I would sooner have ridden through mud, but, striking in my power-gearing, I pegged away, and was rewarded by coming upon an admirable road at last; then we went on through Climping and Flansham, and passed by the rising watering-place, Bognor. Without stopping, we rode through to Owing. About here we came in sight of Chichester Cathedral, of the top of the spire of which we had had glimpses several times.

The Market Cross.

As we entered the town at 3.53 p.m. the sun was shining full on the exquisite old market cross, which is the finest I have ever seen, and directly behind it stood out the noble cathedral and the curious church by its side, both surrounded by trees. Never having been in the town before, I was so surprised at its beautiful appearance that I sat still admiring it for a few minutes, and then went on towards the cathedral as slowly as I could ride.

And now occurred the great disappointment of the day. I wished to have tea at an hotel, and then ride on towards the New Forest until 9 or 10 p.m., or return home, riding as far as possible before bedtime. But my companion had an engagement which compelled him to return to Croydon as early as possible.

We had ridden 63½ miles in 9 hrs. 46 min., rather more than 9 miles an hour, and our stoppages amounted to 2 hrs. 49 min.



Chichester Cathedral.

After taking tea very leisurely, we went and looked over the Cathedral and strolled about the town, and then took the first up train. Mr. Salmon went on to Mitcham, but I got out at Horsham at about 7 p.m., and rode to my home on Reigate Hill. Between Horsham and Crawley, under the shade of the trees of St. Leonard's Forest, it was difficult on a hilly road to push along fast, but once out on the broad open plain leading to Earlswood, though it was a pitch-dark night, I rattled along and reached the town of Reigate at about ten minutes to nine. Coming out of the darkness, the whole town seemed to be lighted up, and people thronged the market-place, in which a brass band was playing not unmusically. Passing between the groups with a kindly word here and there, I received in return an occasional good night, and rode on up the hill, arriving at my home as the clocks were striking nine, having ridden upwards of eighty miles.

I was not in the least tired, and I could easily have ridden twenty miles more, and would have done so had I had a companion, so my ride was an easy one; but since then Hirst, of Croydon, has made me a new machine, which is certainly faster than the Rucker, ridden by me on this occasion, and very shortly I hope to get a Humber Automatic Front-steerer, made lighter, with a higher Crypto-gearing. Such a tricycle would probably enable me to travel nearly a mile an hour faster without increased exertion.

A far more powerful pen than mine would fail to convey to my readers a tithe of the exhilaration I felt during the glorious ride I have so feebly described. Writing at an interval of more than six months, the mere

recollection of the joyous speed maintained for the best part of the way with the greatest ease, the beautiful, varied, and rapidly-changing scenery through which I passed, across Surrey commons and over Sussex downs, through two quaint and picturesque old towns, three seaside watering-places, and a beautiful cathedral city, as well as for miles along the margin of the sea, has again quickened my pulse, and set my heart longing for another day which shall be its parallel, for I cannot hope to eclipse it. Faster and farther in a day I may ride, but with a keener, a more rapturous, feeling of enjoyment—never!

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XXVII.—THE FRAMEWORK OF THE DWELLING-HOUSE.

STRUCTURAL EXAMPLES (*continued*).

THE DISPOSAL OF HOUSEHOLD REFUSE.

IN our twenty-fifth paper* we had occasion to draw attention to, perhaps, the most defective form of frequent occurrence in the furniture of hydraulic apparatus, viz., the pan closet and D trap, and to point out one or two ways by which the evils that arise therefrom can be corrected. The Pan Closet, however, is by no means the only kind of appliance to be guarded against in the choice of a healthy abode. There is another type, known as the "Valve Closet," which is prone to become almost as obnoxious within the dwelling-house; but here there is a range from decided unwholesomeness to perfect efficiency in its mechanism, and a little caution must hence be exercised during an inspection. We shall, therefore, give a brief outline of what may not inaptly be compared to a disease, its diagnosis, and treatment.

The basin of the valve closet is generally bowl-shaped, and can thus be detected and distinguished at a glance from the conical basin of the pan closet. Its outlet, at the lowest part of the basin, opens into a box called the conductor or valve-box, the orifice being closed by means of a water-tight valve, which can be made to move to and fro within the valve-box, by the action of the pull-up handle. The result of this is that, upon driving the handle down, the bottom of the basin is closed, and the last flow of water from the supply-pipe rests at the bottom of the basin and forms a water-seal. In case of accident, such as the discharge of an excess of water, or a trickling down of water through a defect in the cistern or supply-pipe, the basin is provided with an overflow-pipe, which last has a U-shaped bend on it, and opens into the side of the valve-box. The valve-box is in direct communication with a dip trap below, from whence the waste matters are driven into the soil-pipe. Now, the chief defect in this class of closets lies in the overflow-pipe. When the pull-up handle is used, the sudden fall of the water from the basin into the trap beneath is often sufficient, by the time the valve is replaced, to unsyphon the water in the overflow-pipe, which thus remains empty, and affords a patent passage for foul air from the valve-box into the room. Another serious evil is to be apprehended when the overflow-pipe opens into the valve-box in *front* of the valve, instead of behind it; for then, when the contents of the basin are ejected, a small proportion is always liable to enter the overflow-pipe, and decompose within its U-shaped bend.

After all, it may be argued, the defects of the Valve are so trivial when compared with the Pan type, that they are scarcely worth while the trouble of investigation; but it must be borne in mind that in these matters the magnitude of the error has but little weight where disease-germs influence the scale. Hence it is obvious that something must be done to enable the overflow-pipe to fulfil its functions perfectly. One cure is to plug up the overflow-pipe, and thus prevent its action altogether; by this means, when any accident occurs, the water will flow over the top of the basin, which should then be lipped to direct the overflow into the "safe" beneath the closet, and from thence through a warning-pipe into the open air. The overflow may with advantage be disconnected from the valve-box and made to discharge directly into the safe, or into the open air. But two other methods are more usually employed: one is to see that the overflow-pipe opens into the valve-box *behind* the valve, and to ventilate the valve-box by means of a pipe through the wall into the open air away from the vicinity of windows; the other consists in the addition of a small branch-pipe, generally called a service-pipe, to the supply-pipe, which leads to the overflow immediately above its bend, and thus causes it to be replenished with fresh water every time that the handle is pulled up.

Such, then, are the errors of construction in an ordinary valve closet, and the ready expedients to be adopted in case of necessity; but, as we have already stated, valve closets of good form may be employed with absolute safety. Perhaps the best one as yet introduced into the market, and which does not seem to be capable of any further improvement, is the "Lambeth Valve Closet," as manufactured by Messrs. Doulton & Co. Our foregoing observations, as well as the following explanation, will be more readily understood by a reference to the subjoined figure (Fig. 27). It may be as well in this place to note some of the extra advantages to be gained by the adoption

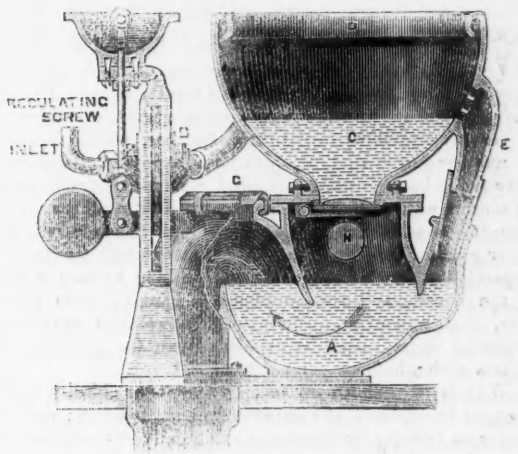


Fig. 27.—The Lambeth Valve Closet.

of this useful invention. The entire structure is so made as to be self-contained—that is to say, it requires but two joints to fit it into its place within the house—one to the soil-pipe, and the other to the water-supply; by this means the expense of cutting away the floors, trimming joists, &c., is entirely dispensed with, and much otherwise necessary labour saved.

The basin, C, is provided with a flushing rim, D, and is so constructed as to ensure thorough cleansing with each discharge of water. The valve is coated with an earthenware facing, which thus contributes very largely to cleanliness. The water is supplied through B, which

* See this Journal, May 1, 1885, p. 375.

is a "Doulton's Patent Regulating Supply Valve," and is so arranged as to give an after-flush without the use of a separate regulator. The overflow pipe, E, enters the body of the trap, A, below the water-line, so that it can never get out of order in the way in which the common form of overflow pipe does invariably. The interior of the trap, A, is lined with a strong, smooth glaze, which is even acid-resisting; its surface cannot thus become damaged by ordinary means, and at the same time facilitates thorough flushing. In case of necessity, a ventilating pipe, H, can be taken to the trap, and an aperture for inspection, G (which consists of a patent cap ground into the opening, and so made that a slight turn either one way or the other is sufficient to disengage or fix it perfectly air-tight), completes what we may with justice term the best appliance of its kind.

Totally different in type is the form known as the "wash-out" or "flush-out" closet, which has been introduced for the purpose of providing an effective yet cheap substitute for the valvate type which we have just reviewed. As a matter of fact, they are not, as a rule, so cleanly as they ought to be. The closet basin is so made as to hold a small quantity of water within its hollow, yet without any pan or valve; hence the opening has to be placed on one side, and a considerable amount of flushing power is therefore required to keep the trap clear. In our next we shall give a special illustration of this variety of closet.

THE EVOLUTION OF THE SENSE OF BEAUTY.

By Constance C. W. Naden.

(*Continued from page* 388.)

We have seen that the baby and the bird are much alike in the origin and nature of their love for "pretty things." But the æsthetic faculty in man, though springing primarily from very simple germs, is subjected to very numerous and complex influences, which increase in number and in complexity as he advances in civilisation. Savages, children, and uneducated persons generally show an almost unbounded love for the brilliant and the novel. The Andaman islanders paint one side of the face red, the other green. One tribe in South America had for its only apparel a macaw's feather stuck in a hole at each corner of the mouth, and strings of shells hanging from noses, ears, and under-lips. In the cave-dwellings are found hollowed stones, used by primitive man for grinding the ochres with which he painted himself.*

Why is it that we do not all keep our childish taste; that we tone down our carpets and wall-papers; that we prefer an interior by Rembrandt to a gaily-coloured nursery picture-book? Why do we not tattoo ourselves, paint our faces red, blue, white, black, and yellow; scar our cheeks and distend our lips? And why do we care about the rainbow and the clouds and the sea, which never seem to awaken the slightest emotion either in a bird or a monkey, and very little in a savage?

As civilisation proceeds, and a leisure class begins to be formed, energies hitherto needed for the maintenance of life are set free for its adornment. We are more and more inclined to employ ourselves in observing evanescent distinctions, half-shades and half-tones, subtle lights which melt into shadows, subtle shadows which relieve masses of light. Glaring contrasts are sufficiently obvious, and have attracted enough attention; and the very same natural love of variety, which makes gaudiness pleasing to the savage, inclines the civilised man to seek new and refined combinations. In his search for a fresh sensation he becomes unsensational. He begins to desire that his art shall be true, as well as attractive and symbolic; and perfect truth can be attained only by the imitation of soft natural hues. The human cheek cannot be adequately represented by a splash of vermilion, nor the human eye by a dot of blue.

Accustomed to the prevalence of subdued tints, and to the sparing use of bright ones, the retina grows more and more sensitive. It is offended by the immediate juxtaposition of complementary colours, while gradation affords the perfection of easy enjoyment. The finer instrument must be kept for finer uses. The razor is unfitted for the function of a hatchet.

The æsthetic and emotional values of different colours now begin to be more definitely settled. Those at the red end of the spectrum are associated with warmth and pleasure; those at the violet end, with coldness and comparative gloom. The golden splendour of the sun, the gleam of sunlit water, the golden-brown or golden-green tinge of the landscape on a bright summer day, the orange-red of ordinary flame, the crimson of sunrise and sunset, the scarlet, orange, or purple colours of summer and autumn fruits; all these belong to the family of reds, and to "the warm precincts of the cheerful day." The cloudless sky is indeed blue, but the prevailing tint of a sunshiny day is certainly not blue, but gold. Blue is associated with gloom and coldness, because it is the last colour which remains visible when the shadows fall. Yellow and red and green are lost one after the other, and the prevailing tint of a clear midnight is deep violet-blue. It may also be noticed that the brighter among the colours which belong to the violet end of the spectrum are rarely met with in nature, and displease, partly because they seem unnatural, and partly because the nerve-endings are not tuned to their special rate of vibration. Very brilliant blue or violet is much more painful than the very brilliant red which reminds us of sunrise and sunset, of mountain-ash berries and of poppies. Brilliant green is unpleasant in the same way, while the tender greens of grass and trees can give only a gentle and sober satisfaction. Even magenta would doubtless be a delightful colour if we were accustomed to magenta roses, but the cultured taste finds it strange and untrue. The highly-evolved organ, being in a state of harmony with external nature, craves for less variety than the imperfect and unstable organ, so that the most cultivated eye will demand little save what is supplied by the environment.

But the utilitarian element has played a large part in the evolution of that æsthetic faculty which finds its best joy in the contemplation of the human form divine. The hen-bird who preferred the most vigorous partner transmitted her taste to her vigorous offspring, so that the taste went on increasing from generation to generation; and the same thing happened to man—at least, in his earlier stages. In primeval days the race was to the swift and the battle to the strong, and swiftness and strength were titles to all power, all glory, all honour. Full development of the muscles, due proportion of the limbs, suppleness and ease of movement, a broad chest, an erect carriage, were the primitive patents of nobility. They were envied, praised, admired. The woman, though not sharing the dangers of the chase and the field, had yet a variety of occupations, and must be healthy and vigorous that she might do her work and bear warrior-children. Luxuriant hair and healthy complexion betokened the natural princess. The love of curved lines and of

* Tylor's "Anthropology."

symmetry were confirmed by the curvatures and the proportions of the body, and by the rhythmic action of the muscles and limbs. Weapons and tools, the products and the instruments of this action, again ministered to the taste for symmetry, and taught a regard for straightness.*

As time went on success began to depend upon mind more than upon muscle, and the face, the index of intellect, was more attentively studied. It was perceived that the projecting jaw, the receding forehead, the high cheek-bones, and the flat nose, with nostrils opening forwards, are characteristics of the lower races, and that they are generally associated with deficient intelligence. As Herbert Spencer points out, "the ideal Greek head is not only free from these peculiarities, but possesses the opposite ones." With its large facial angle, straight nose, delicate mouth and chin, small cheek-bones, it is the very antithesis of the primitive anthropoid ape. It is the type of the god-man, if approach to the divine means recession from the bestial.

And thus grew those glorious images of perfect health and perfect beauty which move us to worship in the Vatican, on the Capitoline Hill, and in the Uffizi Palace in Florence. We worship not Apollo, or Jove, or Venus, but the great goddess Hygeia.

(To be continued.)

FIREARMS AND MILITARY WEAPONS AT THE INVENTIONS EXHIBITION.

IF there is anything under the sun that may be calculated to instil into the minds of the uninitiated a keen appreciation of the difficulties that are to be overcome to maintain our armaments in such a condition as to qualify us for defending our shores, should occasion arise, and at the same time to fill them with a wholesome dread of war and its concomitant horrors, surely we have it at the Exhibition which opened last Monday week at South Kensington. As was indicated a fortnight since, Group XXV., embracing firearms, military weapons, &c., has assigned to it the place of honour, being the first group to meet the visitor's eye as he passes the turnstiles at the Exhibition-road entrance.

There are in all seventy-three exhibits in this section, of which the first and, naturally, the most important, is by the War Department. From the Royal Gunpowder Factory, Waltham Abbey, is a case showing by models the successive stages of the progress made in the manufacture of the various kinds of service gunpowders since 1862. Specimens are also exhibited illustrating the manufacture of compressed gun-cotton, such as is employed for submarine mines (or torpedoes), and for Royal Engineer field and siege purposes. In the same collections are samples of electric lamps, provided with water-jackets, for illuminating the interior of buildings in which the manufacture of gunpowder is carried on. Besides these are models of the largest cartridges used in 1862 and at the present day.

From the Royal Carriage Department, Woolwich, comes a 12-pounder gun, with hydraulic equipment, a hydraulic lifting-jack, and a portable forge for military service.

The centre of attraction, however, is in the selection sent from the Royal Gun Factory, Woolwich, which, besides other implements of destruction, comprises a 12-ton gun of 8-inch bore, which constitutes what has been described as the frontispiece of the exhibition. It is placed with its muzzle towards the entrance, and has at the present time, or had a few days since, shall we say, a grim significance. It is constructed entirely of steel, and consists of an inner core, or barrel, upon which are shrunk a breech-piece and front hoop. Upon these are shrunk the trunion rivets, and a tier of breech-hoops. The charge is fired by a vent-sealing percussion tube ignited by a firing-lock or by an electric current. The gun fires a charge of 105 lb. of cocoa powder, the weight of the projectile being 210 lb. This ponderous mass has at the muzzle a velocity of 1,970 ft. per second, which only drops to 1,805 ft. at a distance of 1,000 yds., where its force is sufficient to enable it to penetrate armour 14·2 in. thick, its penetrating power at the muzzle being 16·3 in. The length of the bore is 204·9 in., the powder chamber being 34·5 in. long, and 10·5 inches in diameter. The gun is rifled with 32 grooves, the twist increasing from the breech to the middle of the bore, the other half being uniform.

There is also a 20 in. "trepanning-bar," a boring tool for removing the material in the form of a solid core instead of entirely in shavings or turnings, as is usually done. It consists of a hollow steel cylinder about ¾ in. in thickness, the working end of which is furnished with a number of cutting tools. A series of longitudinal grooves are cut on the inner and outer surfaces. Streams of water are forced, under high pressure, along the inner grooves, serving to lubricate the cutting edges of the tools, and forcing out on the return journey along the outer grooves the metal cuttings removed by the tools. The bar is usually fixed, and the work to be bored made to revolve, the progress being about 3 in. per hour. It is stated that solid cores as much as 32 ft. in length have been removed by this process, each core so removed being, of course, available for other purposes, instead of being wasted as shavings, as in the old process.

These and a number of other appliances, such as a 12-pounder gun, specimens of sights, and so forth, constitute a remarkably interesting and instructive collection.

The Royal Laboratory officials send a good selection of models of cartridges, shells, fuses, and other ammunition, but one of the most important exhibits is that sent by the Royal Small-Arms Factory, consisting, besides a case of sabres, rifles, and bayonets, of a number of Nordenfelt and Gardner guns of different sizes. Machine guns have recently become of such great notoriety that it is certain there will be a deal of attention bestowed upon them. The Gardner gun is now so extensively adopted into the English service that its efficiency, notwithstanding the many charges brought against it as the outcome of recent troubles at Abu Klea and near Suakim, may be fairly taken for granted. It is stated that in one series of experiments 16,754 rounds were fired with only twenty-four cases of jamming, the maximum rate of firing being 330 shots in thirty seconds. There seems, indeed, to be every probability that the unfortunate failures were due rather to imperfect cartridges than to any defect in the gun itself. Certain it is, however, that the charges should either be proved or disproved, and it would be out of all reason to condemn the authorities for their determination to suspend judgment until the return of the officers interested in the question. Sir William Armstrong has a large exhibit, including a Gatling gun with ten barrels, capable of firing 1,200 bullets per minute with an effective range of 2,500 yards, and at practically any elevation. A stock of cartridges is placed in a circular frame fixed over

* See Mr. Grant Allen's "Origin of the Sense of Symmetry" (*Mind*, July, 1879), and "Æsthetic Evolution in Man" (*Mind*, October, 1880).

XUM

the gun. A handle is turned, a cartridge is deposited in each barrel, and almost simultaneously fired, the empty cases being ejected at the side. Thus, a man, having sighted his gun, may go on grinding out, as it were, death and destruction around him. Such facts as these impart a sombre interest to the foremost collection in the Exhibition. Sir William also exhibits samples of his 40 and 80-pounder rifled breech-loading howitzers, and a mountain gun, with its equipment divided into sections, and mounted on a number of saddles, to illustrate the mode adopted in transporting such munitions.

The Royal Engineers exhibit a collection of torpedo apparatus, together with the appliances used in connection therewith; and to those who saw a similar exhibit three years since at the Crystal Palace some improvements will be already noticeable. There is also shown a large lantern, made by a French house, for an electric search light. Lime-light apparatus, such as is used for night-signalling, is exhibited, together with a heliograph for day signalling. Models of several forms of bridges—spar, pontoon, &c.—are displayed, together with a captive balloon.

The Nordenfelt gun is independently exhibited, as are also the Hotchkiss and Maxim guns, the latter of which is worked automatically after the first shot has been fired. The Maxim gun, we learn, will be worked in the grounds on Wednesdays and Saturdays to demonstrate its powers as an implement of destruction.

Messrs. Easton & Anderson exhibit a working-model of a hydro-pneumatic Moncrieff gun-carriage (as applied for land service), mounting an 18-ton gun, together with a number of photographs of other forms of the carriage. The Moncrieff carriage shows to some extent how far the ingenuity of man has been called upon to assist him in his effort to strike his fellows without risking his own safety. A tall, solid parapet is built in front of the gun which, when loaded, is mounted on rods pivotted on the carriage, at a considerable height, just overlooking the parapet. When the gun is fired the recoil causes it to fall, the supports simply turning round on their pivots. The gun and carriage are then wheeled round on a circular track, and the gun reloaded by men well sheltered against the enemy's fire. The immediate fall of the gun after firing also affords protection to itself, inasmuch as it frees itself from the danger of being unshipped by a well-directed shot. Having been loaded, it is again wheeled round into position, and a small lever controlling a large reservoir of compressed air is worked, with the result that the gun is rapidly raised to its proper elevation. The sighting operation is performed by means of a pair of mirrors which are placed at the opposite ends of one of the gun-supports, so that the officer in charge is under the parapet well out of range.

Besides those exhibits to which reference has been made there are, naturally, several cases of sportman's guns of all sorts and sizes, and for every conceivable purpose; and, taking all things into consideration, an hour or two might very easily be less profitably spent than in studying Group XXV. at the International Inventions Exhibition.

A second edition of Mr. A. Arthur Reade's book on journalism, entitled "Literary Success" (of which a notice appeared on p. 135), has just been issued by Messrs. Wyman & Sons. A number of additions and corrections have been made, which increase its value as a handbook.

Messrs. Cassell & Co. will open their annual exhibition of original drawings in black and white at La Belle Sauvage-yard early in June. Among the works exhibited will be the original drawings executed by Mr. Frederick Barnard for his "Character Sketches from Dickens," published last autumn.

FIRST STAR LESSONS.

By Richard A. Proctor.

THE constellations included in the twenty-four maps of this series are numbered throughout as follows (the names being omitted on the maps, to clear these as far as possible from all that might render the star-grouping less distinct) :—

1. *Ursa Minor*, the *Little Bear* (*a*, the *Pole Star*).
2. *Draco*, the *Dragon* (*a*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*a*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*a*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*a*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*a*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*a*, *Vega*).
15. *Cygnus*, the *Swan* (*a*, *Arided*; *β*, *Albires*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*a*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*a*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*a*, *Regulus*).
24. *Virgo*, the *Virgin* (*a*, *Spica*)
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*a*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.
33. *Orion*, the *Giant Hunter* (*a*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*a*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*a*, *Alphard*).
36. *Crater*, the *Cup* (*a*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*a*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*a*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*a*, *Sirius*).
45. *Argo*, the *Ship*.

GEORGE ELIOT'S DOG.*

By Robert Buchanan.

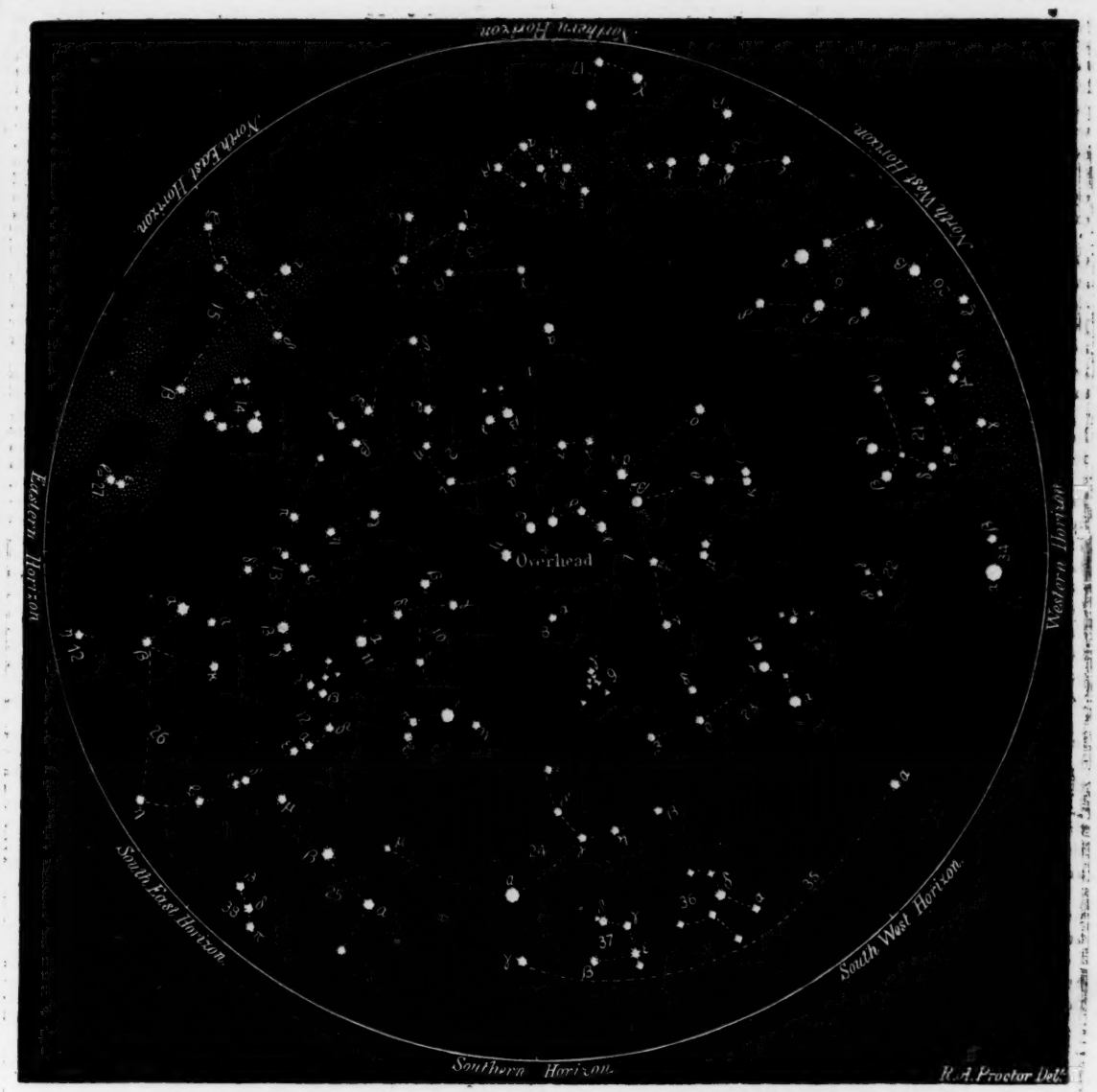
AT this moment there appeared upon the scene another individual, entering quietly through the drawing-room door, which was partly open. The newcomer was a dog, a splendid bull-terrier, who belonged to George Eliot, and generally accompanied Lewes in his walks about the neighbourhood. He came in with a languid wag of the tail and a general air of importance, glanced patronisingly at me, yawned lazily, and stretched himself on the hearthrug at the feet of his mistress.

George Eliot—"The beasts that perish." Here is somebody who, if he could speak, would express a strong opinion upon *that* subject; for he is wise in his generation, and magnanimous almost beyond human conception. Do you know what he did once before he was given to us? The friend to whom he belonged had a little boy, who inherited in full measure the predilections of the archetypal ape.

Lewes (parenthetically).—The true and only substitute for Plato's archetypal Man!

George Eliot—One day, our friend had some acquaintances to luncheon. As they sat together they were startled by a sharp cry of pain from underneath the table; and lifting the edge of the table-cloth, they saw the small human monkey squatted on the carpet, in the act of

* From the *New York Tribune*.



NIGHT SKY FOR MAY (First Map of Pair),

Showing the heavens as they appear at the following hours:—

April 28 at 10¼ o'clock.
May 2 at 10¼ o'clock.
May 6 at 10 o'clock.

May 9 at 9¾ o'clock.
May 13 at 9½ o'clock.

May 17 at 9¼ o'clock.
May 21 at 9 o'clock.

slitting the dog's ear with a large pair of scissors! Out crept the dog, panting and bleeding, followed by his little tormentor. Papa, of course, was very indignant, and seizing the child, who began to sob with terror, announced his intention of administering condign punishment, which he would have done instantly had not the victim interfered. Wagging his tail (just as he is doing now, for he knows I'm telling about him!) the noble fellow rose up, put his paws on the child's shoulders, and affectionately licked his face; then looking at his master, said plainly, in the canine deaf and dumb alphabet, "Don't beat him! please don't! He's only an undeveloped human being; he knows no better, and —I love him!" Could human kindness and magnanimity go further? Yet I don't suppose you will contend that the poor dog's loving instinct was enough to distinguish him from the other "beasts that perish?"

Myself—I'm not sure! Why should not even a dog have a soul like any other respectable Christian?

Lewes—Why not, indeed! I have known many so-called Christians who have neither the amiability nor the discrimination of this dog.

George Eliot—Then here we halt on the horns of a dilemma. Every one with a large acquaintance among decent and "gentleman-like" dogs (as Launce would put

it) must admit their share in the highest humanities; and what is true of them is true, to a greater or less extent, of animals generally. Yet shall we, because we walk on our hind feet, assume to ourselves only the privilege of imperishability? Shall we, who are even as they, though we wag our tongues and not our tails, demand a special Providence and a selfish salvation?

Lewes (laughing)—Buchanan, like all young men, is an optimist! His spiritual scheme embraces every form of existence, as well as the whole human race.

George Eliot—And why, even, the whole human race? Go into the slums and dens of the city, visit our prisons and inspect our criminals, not to speak of the inmates of our lunatic asylums; and what do you find? Beasts in human likeness, monsters with appetites and instincts, often even the cleverness, of men and women. Are these immortal souls, too, independent of physical limitations, and journeying to an eternal Home?

Myself—Certainly. There is no form of humanity, however degraded, which is beyond the possibility of moral regeneration.

Lewes—Optimism with a vengeance! Optimism which leaves out of sight all the great physical factors of moral conduct—hereditary disease, cerebral malformations, thought-perverting congestions, all the endless ills that flesh is heir to. I'm afraid, after all, that the dream of a personal immortality is a selfish one. It would come, in the long run, merely to the survival of the fittest, who would build their heavenly mansion on a hecatomb of human failure. . . . . But there, we've talked enough of things at present inscrutable. Come out into the garden, and soothe your mechanism with a cigar.

We left the Sybil to her meditations, and walked out into the open air. As we strolled smoking along the garden walks, we heard faintly, as from a distance, the murmur of the great city.

"Do you really believe," I said presently, "that the divine thought of Shakespeare was a mere secretion, and that the last word of Science will be one of sheer negation and despair?"

He looked at me thoughtfully, then watched the wreaths of smoke as they curled from his mouth up into the air.

"Man is predoomed to aspiration, as the smoke flies upward. The last word of Science will not be spoken for many a century yet. Who can guess what it will be?"

FLIGHT OF THE BUZZARD.

During my visit to the Southern States of America, I have had several opportunities of watching, under favourable conditions, the flight of the buzzard, the scavenger of Southern cities. Although in most respects this bird's manner of flight resembles that of the various sea-birds which I have often watched for hours sailing steadily after ocean steamships, yet, being a land bird, the buzzard is more apt to give examples of that kind of flight in which a bird remains long over the same place. Instead of sailing steadily on upon outstretched pinions, the buzzard often ascends in a series of spirals, or descends along a similar course. I have not been able to time the continuance of the longest flights during which the wings have not once been flapped, for the simple reason that, in every case which I have attempted to do so, the bird has passed out of view either by upward or horizontal travelling. But I am satisfied that in many cases the bird sweeps onwards or about on unflapping wings for more than half an hour.

Now, many treat this problem of aërial flotation as if it were of the nature of a miracle—something not to be explained. Explanations which have been advanced have, it is true, been in many cases altogether untenable. For instance, some have asserted that the albatross, the condor, and other birds which float for a long time without moving their wings,—and that, too, in some cases, at great heights above the sea-level, where the air is very thin—are supported by some gas within the hollow parts of their bones, as the balloon is supported by the hydrogen within it. The answer to this is that a balloon is *not* supported by the hydrogen within it, but by the surrounding air, and in just such degree as the air is displaced by the lighter gas. The air around a bird is only displaced by the bird's volume, and the pressure of the air corresponding to this displacement is not equivalent to more than one five-hundredth part of the bird's weight. Another idea is that when a bird seems to be floating on unmoving wings there is really a rapid fluttering of the feathers of the wings, by which a sustaining power is obtained. But no one who knows anything of the anatomy of the bird will adopt this idea for an instant, and no one who has ever watched with a good field-glass a floating bird of the albatross or buzzard kind will suppose they are fluttering their feathers in this way, even though he should be utterly ignorant of the anatomy of the wings. Moreover, anyone acquainted with the laws of dynamics will know that there would be tremendous loss of power in the fluttering movement imagined as compared with the effect of sweeping downwards and backwards the whole of each wing.

There is only one possible way of explaining the floating power of birds, and that is by associating it with the rapid motion acquired originally by wing-flapping, and afterwards husbanded, so to speak, by absolutely perfect adjustment and balancing. To this the answer is often advanced that it implies ignorance of the laws of dynamics to suppose that rapid advance can affect the rate of falling, as is implied by the theory that it enables the bird to float. Now, as a matter of fact, a slight slope of the wings would undoubtedly produce a raising power, and so an answer is at once obtained to this objection. But I venture to assert, with the utmost confidence, that a perfectly horizontal plane, advancing swiftly in a horizontal direction at first, will not sink as quickly, or anything like as quickly, as a similar plane let fall from a position of rest. A cannon-ball, rushing horizontally from the mouth of a cannon, begins to fall just as if it were simply dropped. But the case of a horizontal plane is altogether different. If rapidly advancing, it passes continually over still air; if simply let fall, the air beneath it yields, and presently currents are set up which facilitate the descent of the flat body; but there is no time to set up these aërial movements as the flat body passes rapidly over still air.

As a matter of fact, we know that this difference exists, from the difference in the observed behaviour of a flat card set flying horizontally through the air, and a similar card held horizontally and then allowed to fall.

I believe the whole mystery of aërial flotation lies here, and that as soon as aërial floating-machines are planned on this system, it will be found that the problem of aërial transit—though presenting still many difficulties of detail—is, nevertheless, perfectly soluble.—R. A. Proctor, *in Newcastle Weekly Chronicle.*

A suggestion has been made for the establishment of a British Textile Institute. Any one desirous of co-operating in such establishment, either by becoming a member of the Institute or otherwise, may communicate with Mr. Ashenhurst, of the Bradford Technical College, who will supply all needful information.

On Tuesday, 5th inst., Mr. C. V. Boys gave a lecture at the Royal Victoria Hall, Waterloo Bridge-road, on "Light and Colour." Colour was shown to be a property, not of coloured bodies, but of the light by which we see them. This was proved by a row of papers, coloured when seen by magnesium light, but appearing black or grey by the light of the yellow sodium flame. Various dyes, indistinguishable from each other or from ink by this yellow light, were used for painting on a white screen. The gas was then turned up, and bright colours became visible. The next step was to produce a spectrum by bending aside a beam of white light with a prism. To show that there was no colouring matter in the prism, white light was reproduced by bending the beam back to its original direction with a second prism. The effect of red glass in stopping the green rays, and of green glass in stopping red rays was shown, darkness being caused by passing the beam through both glasses. The action of the colours used in painting is like this: they reflect to the eye coloured light because they have robbed the white light which fell on them of one of its constituents. Thus we get black by mixing paints of all colours together. When, however, we mix, not paints, but coloured lights, so that one light is added to another without anything being destroyed, we get white. This was done by rotating a disc with coloured sectors, so that before one colour had time to fade from a given part of the retina, another colour was presented to it. The result was that the disc appeared white. Mr. Boys wound up by showing the effect on coloured objects of various brilliant monochromatic lights.

Editorial Gossip.

I SINCERELY hope that every one interested in technical education—and especially the members of the various City Guilds, whose funds are being so merrily spent for them—will read the admirable address delivered by Dr. Percy before the Iron and Steel Institute on the 6th instant. Here are words which may well be pondered over by those who are being led by the nose by an astute clique wholly and solely for their own profit:—

> Of the advantage of special instruction adapted to special artificers, in addition to what they could acquire in the ordinary practice of their respective arts, there could not, he presumed, be two opinions. But, on the other hand—and this was the point to which he desired to direct particular attention—he contended that there was a large number of artisans who would not be rendered more competent by instruction of that kind. In support of this contention he adduced file-cutters by way of example, and others, whose sole industrial work was the performance of one and the same mechanical operation. Nothing in the way of manipulation was more calculated to excite surprise and admiration than the marvellous skill which a file-cutter displayed in the practice of his art. This was, indeed, an illustration of technical education in the truest sense. It would puzzle some of those gentlemen who talked so glibly and profusely about technical education to suggest an improvement in that of the file-cutter. Let him be saturated with knowledge of all the mysteries of iron and steel, and he certainly would not in consequence become a more skilful artificer, any more than would a sculptor by being informed that the marble on which he operated was composed of carbonic acid and lime.

The plain common sense of this must commend itself to every impartial person; but, of course, "Central Institutes" and the like are established for the benefit of the *teachers;* that of the taught being a very ancillary matter indeed. The Science and Art Department doesn't give instruction in file-cutting, though!

THE attempt of the Royal, Noble, and Right Honourable showmen at South Kensington to imitate the dignified and honourable tactics of the directors of the opposition exhibition at Norwood, seems to be exciting disapprobation and indignation in the very outset. Presumably, because the public has been apparently content to be deluded into visiting the Crystal Palace under the false pretence that the admission is only one shilling (the fact being that the visitor is stopped at every turn to pay 6d. extra for this, 3d. extra for the other, and so on), the exalted proprietors of the show at Brompton appear to have thought that a *soupçon* of quackery in their advertisement would "draw" equally well. Here is their own announcement, cut from page 3 of their official "Railway Guide and Route Book":—

> INTERNATIONAL INVENTIONS EXHIBITION, 1885.—Season tickets, one guinea each, admit to all parts of the Exhibition, including the Royal Albert Hall and the Royal Pavilion, and are available for the whole duration of the Exhibition. Holders are entitled to witness the opening ceremony (May 4th), and to visit the Exhibition every day (except Sunday).

FROM letters which have appeared, however, it would seem that the absolutely unqualified words, "the whole duration of the Exhibition," and "every day (except Sunday)," must be taken to mean that on four fête days (two Wednesdays and two Fridays) the happy possessor of the season-ticket will be again called to pay for his admission after 6 p.m.; and that, save on similar extra payment, he will be excluded from the Albert Hall on six Wednesday and two Saturday afternoons, and on all Wednesdays after 6 p.m. As they seem to have gone permanently into the show business, the Commissioners might with advantage consult Mr. P. T. Barnum, and take a lesson out of his book in matters like these. It is very silly of them to kill the geese that have for the last year or two laid them such an abundance of golden eggs.

ANOTHER particularly paltry piece of sharp practice, too, I discovered on Friday last, when I paid my own first visit to the show. A great parade is made, in the official guide, of an alleged boon conferred on the public, which is set forth (pp. 26 and 27) in the following words:—

> By special arrangement with the railway companies, a scheme has been made available within a radius of twenty-five miles (or thereabouts) by which joint tickets can be obtained at the stations named in this Guide, such tickets to cover the entire railway journey (*by the shortest available route*) to and from South Kensington, the use of the Subway, and admission to the Exhibition.

WOULD, or could, any human being, reading the words "The use of the Subway" above, come to any other conclusion than that the railway tickets enabled their purchasers to proceed straight from the station by the covered way into the Exhibition without further fee or charge? And yet there is a turnstile with a penny toll (! ! !) to be paid both on entering the building and leaving it. It is to be hoped that some one, finding himself thus further mulcted for what he has already paid under an implied contract, will try this matter out in the county court; in fact, I am not quite convinced that the issuers of the announcement I have copied above do not bring themselves within the four corners of the Statute 24 & 25 Vict., c. 96, s. 88.

WHEN once in the building there is a good deal to interest the visitor—notably in the exhibition of recent improvements in implements of warfare, in the department of machinery, &c. Much, however, shown is familiar enough, while the old nuisance of refreshment-rooms, bottled beer, buns, and eating and drinking all over the building exists in full force; and the cigarette-stall, with its gaily-attired female attendants and the like, is not wanting to accentuate the Cremorne element, so patent the moment the galleries are quitted and the grounds entered. In fact, disguise it as they may under a cloud of high-sounding language, the Commissioners are merely competing with other caterers for public amusement, and while supplying those interested in applied science with a certain quantity of material which will really repay inspection, bid even higher still for the patronage of 'Arry and Hannermariar in their "evenings out."

Reviews.

SOME BOOKS ON OUR TABLE.

The Lady's Journal of Decoration. Vol. I., Part I. (London: H. Vickers.)—Ladies who desire to make their homes artistic and beautiful without extraneous aid, will welcome the remarkably cheap serial of which the first number lies before us, crowded as it is with capital designs for fans, plaques, tapestry, embroidery, painting, etching, and other aids to the adornment of the interior of a house. If we may accept the first number as an earnest of what is to come, we may well look forward to a really valuable contribution to the economical pursuit of art for the purposes of domestic decoration.

New Commercial Plants and Drugs. By T. CHRISTY, F.L.S., &c. (London: Christy & Co. 1885.)—Those interested in economic botany will find in Mr. Christy's

pamphlet a description of various recently-discovered vegetable substances, useful either as foods, in the arts, or as medicines. A coloured plate of the Kola-nut forms the frontispiece.

In the Watches of the Night: Poems. (In eighteen volumes.) By MRS. HORACE DOBELL. Vol. VI. (London: Remington & Co. 1885.)—Here the authoress has it out with her critics, some of whom, in 'Arry's refined phrase, "get it hot." This is the way that Mrs. Dobell deals with one unfortunate creature, whose Bœotian dulness must have prevented him from recognising the Divine afflatus in her "poetry":—

> Had he been—hum! hum! hum!—so that his eyes
> Were slightly "obfuscated"!—and his brain
> Rather too wandering to be *quite* as wise
> As usual—but this point we will not *strain*.

How that critic will writhe when he reads this refined—if scathing—sarcasm!

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

All Remittances, Cheques, and Post Office Orders should be made payable to MESSRS. WYMAN & SONS.

The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

THOUGHT AND LANGUAGE.

[1703]—The concluding sentence of No. VIII. on this subject (p. 366) expresses exactly my opinion. "Articulate speech has grown up with the mind of man, and could not exist without it." But above I read, "his mental superiority *which had been attained in the struggle for existence.*" The words I have italicised beg the whole question. Let others judge whether it has been proved that this *was* so attained. I think otherwise.

Later, it is written that language is to man as the evil smell is to the skunk. Why not say man is to language as the elephant to his trunk?

"All animals that have survived have been enabled to do so in virtue of developing a protection against adverse surrounding circumstances."

Is this so? I thought it was the contrary, *i.e.*, that there are myriads of species which have no special—certainly no imitative—development, and relatively few which have. What is the *developed* "protection against adverse surrounding circumstances" possessed by the lion, whale, eagle, crocodile? I cannot even admit that it is strength; the tiny monkey, the fly, the flea, the worm, have no defence whatever, yet survive.

"Development in man has taken place by way of the nervous system; he has gained brain force." I say again, it is not demonstrated that he got his brain-force by development. I in no way advocate "the special creation of man." I simply say that, given man, there you have everything potentially which he has since advanced to; that he has devoloped language, not language him—*i.e.*, I differ from the writer as to which is cause, which effect. As to survival—is there not a tendency to underrate the obstinate fecundity of nature? Herodotus tells us (Lib. II. c. 66) that there would have been no cats in Egypt had not the toms killed all the kittens; also that the cats would have eaten up the country but for the same thing. These apparently contradictory statements are thus reconciled. The male cats found the females drove them away when they had kittens. The toms, disliking this, killed the kittens, and so obtained restitution of conjugal rights. He says "the kittens" simply, which logically means "all the kittens." But, of course, a few must have escaped; and it was these few only—not "the fittest," of course—which sufficed to keep up the race in great abundance. Here was a peculiarity developed by a species, tending more to its extinction than its survival.

I beg to add that Herodotus tells us also there were tribes of men in his time who had *no* language—were ἄφωνοι. How did *these* survive?

"The elephant alone has a trunk; therefore he has survived."

"Man alone has articulate speech; therefore he has survived."

I declare that these two statements are exactly parallel.

In a word, I asserted, in my first letter on this subject, that man's position is due to his mental superiority *alone* (however attained or manifested). This is taught in this paper, No. VIII.; but (I cannot help saying) it seems to me there has been a slight change of front. I certainly did not attack what I myself maintain.

HALLYARDS.

DARK TRANSIT OF JUPITER'S IVTH SATELLITE.

[1704]—In last week's KNOWLEDGE we had a letter from Captain Noble, communicating the results of Dr. Spitta's observations of the transit of the IVth satellite of Jupiter, on the 18th ult.

Having witnessed the event with a 3½-inch Wray, of most excellent definition, and being favoured with one of the best nights for seeing Jupiter, as well as for dividing close doubles, I give the results:—Turning my glass on Jupiter at 9 p.m., I found the satellite near the centre of the planet; in colour, it seemed of a deep neutral tint. I thought, at first, it had an oval form, with its major axis pointing north-west.

Getting into that state of repose necessary for critical observation—mind and eye becoming only a register of what appears—the disc of the satellite seemed quite round.

When one-fourth of distance from rim its colour seemed toned a little with the colour of the belts, and fainter; at one-sixth from rim it was becoming difficult to hold in colour, and had no perceptible difference from colour of belts; shortly after this I lost it.

I turned the instrument on the doubles *o* Cancri, *δ* Gemini; both were well seen, but I could not find the lost satellite again. I did not wait to see it come.

G. L. BROWN.

ADULTERATION OF DRUGS.

[1705]—In your "Editorial Gossip" (KNOWLEDGE, April 24, 1885), speaking of fraudulent substitution, you say:—"This is akin to the behaviour of a chemist who makes up a prescription (on which the life or death of the patient may hang) with adulterated drugs."

To knowingly do such a thing is, indeed, most reprehensible; and I do not think I exceed the truth in saying that a very small percentage of chemists can be found who would lend themselves to wilful adulteration of any kind. But let us for a moment inquire into the real meaning of making up medicines with drugs which can be guaranteed pure. The Materia Medica includes roots, barks, leaves, gums, resins, and many other natural products, both of home and foreign origin, all of which may be, and often are, adulterated before they leave the countries producing them. In addition to these, the name of chemical products is legion, any of which may, by accident or design, leave the hands of the large manufacturing chemist in an impure state. There must always be many things which the retail druggist must purchase, since it is idle to suppose that he can, for instance, grow his own poppies and obtain therefrom opium of his own manufacture; so also is it equally impossible for him to make his own carbonate of soda and such things. What, then, must he do in order to be sure that he never administers to any person in a medicine substances other than those ordered by the doctor? Simply this: he must carefully analyse all things which he buys before putting them into stock. Now, this means that he must be a skilful analytical chemist and a good botanist. To bring the retail druggist up to this standard has ever been the aim of the Pharmaceutical Society.

But if the public wants the pharmacist to be a specially educated man, it is only fair that it should offer something in return. The only possible way to do this appears to me to be to grant to qualified men a monopoly of the sale of drugs and medicines. By granting this to chemists as a class, and at the same time insisting upon their being responsible for the purity of their wares under a heavy penalty, the public will be, indeed, benefiting itself. The ill or dying will not lose their last chance by the failure of a remedy at a critical moment, and the public will get its medicines pure in spite of itself.

At the present time, the passing of the Pharmaceutical examinations merely confers on a chemist the right of placing the

words "chemist and druggist" over his door, and of selling scheduled poisons. It is competent for any person, no matter how illiterate, to open a shop resembling a chemist's in the most minute particulars, and carry on a trade in drugs, providing he does not infringe the two above regulations. Grocers and others also sell drugs of whose composition they are usually supremely ignorant.

Now all this is deceiving the people. I contend that the public generally should not be allowed to buy impure Epsom salts any more than impure morphia. The reason for this is, as has been well said, that whereas the public can form a rough estimate of the purity of its food by taste, smell, and appearance, it is absolutely powerless in the matter of its drugs. It would buy, unconsciously, quinine mixed with, say, morphia, and the coroner's verdict of "death by misadventure" would be no satisfaction to the bereaved relatives of the deceased. You certainly run the double risk of getting poisoned, or of getting inert medicines, unless you confine the sale of drugs to competent men who have scientifically examined them before offering them for sale.

I fancy that by bringing to your notice the above facts I am, while apparently fighting for a class, really dealing a blow for the general good.—Yours obediently,

T. FAWSSETT.

[Are we to understand that, when drugs become effete and inoperative from age, druggists (wholesale and retail) throw them away? Mr. Fawssett's letter contains the germ of what seems to me an excellent idea: I mean that of making the sale of medicines and poisons a practical monopoly, and greatly increasing the personal responsibility of those to whom it is granted. This principle is already in operation with regard to intoxicating liquors. Free trade in active and powerful medicines does seem a terrible mistake.—ED.]

MANUFACTURE OF CRYSTAL SODA.

[1706]—In reply to E. Jackson's question in your last issue as to how crystal soda is made, I may say that it is made by one of two processes, both of which are carried out on a very large scale, and both of which commence with the same raw material, viz., common salt—sodium chloride.

1. The Leblanc Process:—The salt is heated on a furnace bed with sulphuric acid. Sodium sulphate (salt-cake) is formed, and hydrochloric acid, used for making bleaching powder, is evolved.

$$2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl.$$

The salt-cake is then heated in large revolving furnaces with small coal and limestone. The fused mass is poured into iron barrows and allowed to cool. This product, or "black ash," consists of a mixture of sodium carbonate and calcium sulphide, besides many impurities. The following equation explains its formation.

$$Na_2SO_4 + Calcz + 4C = Na_2CO_3 + CaS + 4CO.$$

The sodium carbonate is then extracted by treatment with warm water, in which it is very soluble, the calcium sulphide remaining behind as a mud at the bottom of the vats. The solution is drawn off, settled, and evaporated nearly to dryness, the solid matter drained and then calcined. It is then known as soda-ash. This is dissolved in hot water, allowed to settle, and then run into crystallizing cones. Here the "Soda crystals"

$$Na_2CO_3 + 10H_2O$$

separate out, and after draining are sent into the market.

2. Solway's Ammonia. Soda process.—In this process the brine, *i.e.*, solution of salt, is saturated with ammonia, obtained from gas liquor by boiling with lime, and the solution thus formed treated in high towers with carbonic-acid gas. The slightly soluble bicarbonate of soda is precipitated, allowed to drain, and ignited, thus yielding a very pure soda-ash, which is then treated as above. The formation of the bicarbonate of soda is shown by the following equation

$$NH_3 + NaCl + CO_2 + H_2O = NaHCO_3 + NH_4Cl$$

Then on ignition

$$2\ NaHCO_3 = Na_2CO_3 + H_2O + CO_2$$

The ammonia used can be, to a great extent, recovered.

CHEMIST.

IDIO—NOT HETERO—CENTRICISM; THE SCIENTIFIC *RATIONALE* OF THE UNIVERSE.

"The proper study of Mankind is man."—*Pope.*

[1707]—Though, hitherto, I cannot certainly plume myself on success in rendering intelligible to the editor, or readers of KNOWLEDGE, the *data* of Hylo-Idealism, perhaps no objection will be raised by the former to the insertion of one more attempt at this scientific and crucial synthesis—naïve and self-evident as any other truism, seen, when fairly grasped, to be incontestable. The whole *onus* rests on the idiotism—the plain, commonplace matter of fact that the world, as we see, or think, or know it, or in other words, thought and its objects, can be nothing else than a phenomenon or idea of our own sense and thought mechanism, and hence a closed autopsy or auto-morphosis. So that, in "reality," or "ideality,"—style it as we will—no such entity as thing or object exists for cognition at all; each object receiving asselfment ere amalgamated with our personal consciousness or egoity; outside which is not even the "reign of chaos and eternal night," but of blank nullity itself. We thus never reach knowledge of things in themselves, *i.e.*, their own nature, but only states of our own consciousness, fabricated out of "substance" Locke already terms "I know not what," by our own sensifacient and mentifacient organic machinery. Bishop Berkeley certainly was a mystic, and his Absolute Idealism has really no *locus standi* whatever, as aptly stated in the editorial note to "C. N.'s" reply to the vulgar realism of "J. S." (*Qu.* John Smith?) [1681]. But still this impracticable visionary, like others of his kidney, as Kepler, Columbus, &c., has his legitimate rank in the hierarchy of discovery. He *did* prove to the satisfaction of subsequent philosophers like Hume, Kant,* &c., as well as of common sense, that the eccentric excitant of sensation can impossibly resemble the centric sensation itself. And this formula, when reduced from the absolute or ontological to the relative or phenomenal sphere, yields all results contended for by hylo-idealism. We are thereby landed in the sure and certain faith that the only universe—abstract or concrete—to which human sense or thought has access is a brain-created one, and therefore must necessarily be a process from the self in which the not-self, before apperception, must be absorbed. The "το παν" is thus reduced to the ghostly, apparitional, or phenomenal standard of which the cerebral convolutions, or *cortex cerebri*, are the real manufactory; idea, vision, spectrum, ghost, phenomenon, apparition, phantom, &c., are rigid synonyms and correspondences. The only difference between ordinary, work-a-day experience and such night-side forms of Nature as the brain-coinage of the apparitions in "Macbeth" and "Hamlet," is that normal sight and sense proceeds from a sound, while abnormal visions are evoked by an unsound sensorium. The metaphysical media between mind and matter (vesiculo-neurine), from which latter, in the guise of "substantial forms" and "intentional (notional) species"—a *tertium quid* invented to salve the supposed passivity of body or matter—even the sensationalism of Locke is not exempt, are clearly only a malconception of the automatic special function, or *propre vie*, to use Bichat's idiom, of the grey or cellular structure of the hemispherical ganglia. The moral of this theory is that a healthy body or brain is the essential physical basis both of a healthy mind and of cosmical order, which is the mind's creature. Chaos, not cosmos, must be evolved when the *officina mundi* is out of gear, and hygiene is thus seen to be the complement and tye-beam of the sciences. Kant, who originated, though more as adumbration than entelechy, this auto-centricism, compares the "wheel-about" it executes to that of Copernicus when he substituted Helio-centricism for Geo-centricism in astronomy.

ROBERT LEWINS, M.D.

[As Dr. Lewins persists in his idea that his theory has not been properly apprehended, I have yielded to his request to insert this reiterated exposition of it. It must, however, be distinctly understood that—for reasons more or less plainly hinted at on previous occasions in these columns—nothing more on this subject can be admitted.—ED.]

TASTE.

[1708]—In reply to letter 1684, I do not think your correspondent has at all hit the mark with regard to taste; but I do not know if it has ever been satisfactorily defined by any one. With regard to the engravings given, I am not quite sure that the picture-frame, No. 3, is not shown in as good taste with irregular margin, as so stiff a pattern would be with regular margin, say by duplication of the right-hand side, and bottom for the left-hand side and top. Neither is it certain that the nave (Fig. 4) is in bad taste because it is not symmetrical. With regard to a purely geometrical figure, as the Ionic capital (Fig. 2), the arguments offered would, perhaps, hold good. With regard to the Corinthian capital, this associates itself with a tree or plant, and to see this reversed is an anomaly. The face, also (Fig. 1), has a distressed look, as from toothache; these, of course, in an ornamental sense, would be in bad taste. And I have no doubt that natural and pleasurable association has much to do with taste. I entirely disagree that things on the same level should be symmetrical to be in good taste, although symmetrical things may be so.

This is very evident in the ornamental products of the Japanese, a nation notorious for taste even in the cheapest and commonest

* Schopenhauer, indeed, asserts that the leading doctrines of the "Critique of Pure Reason" are merely plagiarisms from the transcendentalism of Berkeley.

manufactures; and the Japanese rarely make two sides of anything entirely symmetrical, except at most in the extreme outline. Thus, in a cabinet he makes one door higher than the other, and in these articles of taste every drawer is of different size, and every surface of different ornament. Among the superior middle-class a lady devotes great attention to the taste of her drawing-room, and I think every one must admit the prevailing good taste in this. And if we mark the instances of bad taste, it is generally from stiffness—geometrical or symmetrical patterns of the carpet and paper. Pictures placed in perfect order, commonly one large picture and a pair each side at equal distance and height, table in centre of room, sofa with a similar chair on each side, &c., whereas great taste may be found where symmetry is strictly avoided. From observation, I think certain conditions of good taste may be defined. 1. An article should be adapted to the purpose it is intended for. 2. Prevailing ornamental parts should refer to pleasant associations in nature—thus, the female figure in early womanhood, merry children, swans, deer, flowers, or combinations of these, always placed in profile, or partly so, not to appear of symmetrical outline unless there is great projection so as to obtain oblique view. 3. Natural or semi-natural objects adapted to art *ingeniously*. W. F. Stanley.

"DE GUSTIBUS."

[1709]—May I trouble you with a few comments on the instances adduced by "An Old Draughtsman" in support of his theory concerning the principles of taste (letter 1684)?

Fig. 1. This sketch is unsatisfactory owing to the, to say the least of it, dispiriting association of ideas it calls forth. Fig. 2. In all the great examples of the Ionic order the two volutes of the capital are symmetrical; therefore, as the eye will not approve of tampering with old associations unless the necessity is manifest, the form shown in the sketch is displeasing. Fig. 3. This raises a question of taste wherein the tastes of many people of unquestionable taste would certainly not coincide. Fig. 4. For very obvious constructional reasons, it is preferable that the two sides of the nave of a church should be symmetrical, but a comparatively trifling modification of this sketch would turn it into a decent side aisle. Fig. 5. Although this certainly appears a bad design for a bird, there are many most magnificent works of art both in the precious metals and in clay that are but modifications of this same type. Fig. 6. As stiff-leaved foliage growing downwards is rather uncommon, the associations physical as well as architectural are much against this design. Fig. 7. If for some especial purpose a rudder at each end was found desirable, the appearance of a vessel so built would not necessarily be distasteful. As a matter of fact, many beautiful little vessels, having no rudders at all, are alike at each end. Fig. 8. Although in a large church the extremities are not usually symmetrically disposed, they are so in many other buildings equally magnificent; and, even in the case of a church, you may commonly be able to find a not ineffective point of view from which the visible extremities appear fairly balanced.

I have ventured to take separately each example submitted by "An Old Draughtsman," and to view it from a rather different standpoint. In doing so I find that these same examples do not then support his theory. I believe that if ten, twenty, or a thousand different persons each chose a position from which to consider the lessons to be derived from these sketches, then ten, twenty, or a thousand different theories on the principles of taste, would infallibly be evolved. J. B. C.

LETTERS RECEIVED AND SHORT ANSWERS.

Thomas Ayers. It by no means follows that Dr. Lommel ever heard of your theory. There is nothing in the chapter to which you refer which he may not have derived from Young, Herschel, Séguin, Mayer, &c. Of course, there have been floods, local and partial, at all periods of the earth's history, and of such as have occurred since man's advent on earth tradition would naturally hand down accounts, more or less exaggerated, in every country in which they had happened. Your watch-escapement invention only affords another illustration of the "tulit alter honores" of Virgil. —William Rice, E. Wright. Received.—E. P. is anxious that Mr. Grant Allen should furnish an article on the formation of branches, describing the part of the tree in which they have their origin, how young shoots are formed on the hard bark of an old tree-trunk, &c.—Dr. Lewins. You will see how, once for all, your reiterated exposition of your theory has found a place in our correspondence columns.—A. J. W. As you requested, I sent your letter on to "F.R.A.S.," who, in reply, says: "I myself observed the transit of Jupiter's IIIrd Satellite on Saturday night, but did not turn the telescope on to the planet until after ingress had occurred, when the Satellite was invisible. I left the instrument at 8h. 30m., returning to it at 9h. 35m., when the Satellite was plainly seen as a dark (though not black) spot, not quite half way across on the Northern Equatorial belt, and *just* within its northern edge. The dark marking on the Southern belt of which your correspondent speaks was also very plainly visible. By 10h. 15m. the Satellite had travelled past the Central Meridian of the planet, and was by this time so much darker, that an inexperienced observer might well have been excused for mistaking it for a shadow, instead of a Satellite at all. I did not wait for the egress." The instrument employed was a larger and more powerful one than yours. The sequence of phenomena you observed is the usual one. The IIIrd and IVth Satellites ordinarily enter on to Jupiter's limb as tiny bright discs, disappear, save in the very largest instruments, for a longer or shorter interval, and then reappear when well on to Jupiter's disc, as dark or even black spots; the phenomena recurring in reverse order, at egress. It was the departure from this all but invariable apparition which conferred such interest on the observation of Dr. Spitta, kindly communicated in Letter 1687 (p. 378) by Captain Noble.—W. Just so, but you see that "Holmdale" does *not* possess a telescope mounted at all in the fashion necessary to determine the meridian by an observation of Polaris. *Imprimis* it must have a truly vertical motion in altitude; next a system of cross wires to define the line of collimation; and, lastly, means of illuminating those wires. Of course, by "noon" is meant apparent noon, or the instant of the sun's transit over the meridian, and not *mean* noon at all. No reference to a clock is needed in the method recommended for "Holmdale's" adoption. As for the difficulty of describing circles round a given point on a flat board, sticking a knitting-needle into their common centre, and levelling the board, a pair of compasses and a carpenter's square and level are all the apparatus needed. By the bye, what you say about the shadow of the top of the needle suggests to me to add that a piece of card at the top of the needle with a pin-hole in it would give a better-defined point on the circumference of either of the circles. Now for your improved method. Let "Holmdale" provide himself with a telescope, fitted as I have described above, and then (to copy your directions), "On the 19th inst. the Pole Star will be exactly north from Cheltenham at 9h. 25m. 10s. p.m. (or at 21h. 25m. 10s., if you prefer it so), Greenwich time. Get it into the centre of the field of your telescope." Noting particularly that, to attain anything approaching accuracy, this centre must, as I have said above, be defined by cross wires, you should have gone on to add that "Holmdale" must lower the telescope (in a truly vertical line) until some terrestrial object is on the intersection of the wires, and that then a line drawn from such point to the point on which a plumb-line dependent from the optical centre of the telescope falls will be the meridian. The ease and simplicity of your method will commend itself at once to an observer possessing no apparatus whatever! It is fully evident that your theoretical knowledge of astronomy considerably exceeds your practical acquaintance with it.—An Ally of "Knowledge." By means of an alcoholometer—a weighted glass bulb with a graduated stem, which, upon immersion in a mixture of alcohol and water, shows the percentage of the former by volume at once by inspection.—F. W. Rudler. Received with thanks.—John Reed suggests that a scale should have been appended to the plan of the Inventions Exhibition, on p. 373. Possibly the writer of the article which it illustrates may be able to supply this. —T. C. I will have some inquiry made, but it must be borne in mind that the mere appearance of an advertisement in the columns devoted to that purpose can, in no way whatever, be held as affording any guarantee of its *bona fides*. It is a purely business matter, entirely distinct from the literary portion of the paper itself proper, and with which the conductor has nothing whatever to do. Do you suppose that the Editor of the *Times* pledges himself to the truth of the cures alleged to be effected by quack medicines advertised on the outside sheet of his paper?—Senex asks for some lighter and more portable instrument than the usual heavy hand-lens to aid him in reading. Will any correspondent kindly say where such a contrivance can be procured?—Walter F. Poingdestre. Many thanks, but I have an inexorable rule not to admit poetry, either light or serious. Why not try one of the comic papers with yours; it is sufficiently clever.—Hallyards. Your estimate of Miss Naden's ability, high as it is, is none too high. The MSS. returned much too long; nor is the form in which they are cast suitable for insertion. Condensation, and not diffusion, is what is needed in the correspondence columns here. I also return your letter on a remarkable phenomenon. To admit that would be to open a floodgate of the most unprofitable possible discussion. Are you thoroughly sure that Maskelyne was not quietly "humbugging" that interviewer?—James Gillespie. You must really forgive me if I say that your hypothesis (or, as you call it, theory) is downright hopeless, irredeemable nonsense. Wrong even in your elementary facts, you are, if possible, more so in your inferences.

To give a single illustration: γ Draconis is in the zenith of London at its upper culmination, and *never* sets there; continuing to circle round and round the pole. It never approaches nearer than 13° to the horizon. Do let me beg of you not to continue to send me quires of stuff that is really not worthy of examination by any thinking man. —O. B. I have not the most distant notion who the Professor quoted by Macmillan is—or was. There is an amount of turgidity in the quoted specimen of his diction, though, leading irresistibly to the inference that his "eminence" may possibly be of a debateable character. The almost equally sensible lines to which you subsequently refer as "nonsense," were written by Foote, the actor, to test the memory of Macklin, who asserted that he could repeat *anything* by rote after once hearing it.

Our Mathematical Column.

MATHEMATICS OF METEORIC ASTRONOMY.

By RICHARD A. PROCTOR.

(*Continued from p. 403.*)

LET us next take the case of one of the giant planets, for example the planet Jupiter. Here we may conveniently use equations we have already obtained for the sun, substituting the proper values for Jupiter. Thus, the mass of Jupiter is 1-1048th of the mass of the sun, so that μ for Jupiter

$$= \frac{31,298,800,000}{1048} = 29,870,000.$$

For a body starting from rest at an infinite distance, and reaching Jupiter under his sole attraction, we obtain the equation (as before)—

$$v^2 = \frac{2\mu}{x}$$

And taking 86,000 miles for the mean diameter of Jupiter, we obtain for the velocity with which a body approaching Jupiter from without would reach the planet's surface

$$v^2 = \frac{2 \times 29,870,000}{43,000} = \frac{59740}{43} = 1389{\cdot}3$$

or $v = 37\frac{1}{2}$ miles per second.

Let us next see what would be the actual increment of velocity produced by the action of Jupiter, supposed to be at rest, on a body starting at rest from an infinite distance towards the planet as at J (Fig. 3) in the direction A J S, S being the sun.

Fig. 3.

Put J S = R; P S = x = Jupiter's distance from the sun = 481,780,000 miles; P Q = dx; then, we get (as when dealing with the earth) the equation

$$\left(\frac{dx}{dt}\right)^2 = \frac{2\mu}{x} + \frac{2\mu'}{(x - R)} + C$$

where $\mu = 31,298,800,000$ and $\mu' = 29,870,000$.

When the body starts from rest at an infinite distance, we have C = 0. Wherefore, in this case,

$$v^2 = \frac{2\mu}{x} + \frac{2\mu'}{x - R}$$

Now, put $(x - R)$ = Jupiter's radius = 43,000; and $x = 481,780,000 + 43,000 = 481,823,000$. Then we have

$$v^2 = \frac{2 \times 31,298,800,000}{481,823,000} + \frac{2 \times 29,870,000}{43,000} \qquad (a)$$

$$= 129{\cdot}9 + 1389{\cdot}3 = 1519{\cdot}2$$

$v = 39$ miles per second.

In other words, the velocity with which a body travelling to Jupiter and the sun, supposed to be both at rest and along its line of approach, would reach Jupiter's surface under the combined influence of the attractions of both these orbs, would be but $1\frac{1}{2}$ miles per second greater than the velocity with which a body would reach Jupiter under his own attraction alone, the approach in both cases being made from rest at an infinite distance.

Observe, again, that the number 129·9 represents v^2 for a body approaching the sun (from rest at an infinite distance), when at Jupiter's distance from him. The velocity of a meteor when at this distance from the sun, if the meteor has simply been drawn from out of interstellar space, is therefore $\sqrt{129{\cdot}9}$, or $11\frac{3}{4}$ miles per second.

We notice that under the conditions here specified Jupiter adds a velocity of $27\frac{3}{4}$ miles per second ($39 - 11\frac{3}{4}$) to the velocity with which, were Jupiter away, a body would reach Jupiter's distance from the sun under the sun's attraction only. We notice, also, that a body ejected from Jupiter placed as at J (Fig. 3), so as to start from Jupiter's surface towards A with a velocity of 39 miles per second, would pass away into interstellar space, never returning to the planet.

And just here we may for our amusement ask ourselves what would happen if a body set out from Jupiter's surface on the side towards S (Fig. 3) with this same velocity of 39 miles per second.

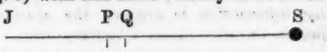


Fig. 4.

In Fig. 4, let J S = 481,780,000; P S = x; P Q = dx. Then, since now Jupiter's action tends to retard tne motion of the body on its way towards S, the equation of motion is

$$\frac{d^2x}{dt^2} = -\frac{\mu}{x^2} + \frac{\mu'}{(R - x)^2};$$

whence, as in the other cases,—

$$\left(\frac{dx}{dt}\right)^2 = v^2 = \frac{2\mu}{x} - \frac{2\mu'}{R + x} + C.$$

Now when $x = R - 43,000 = 481,737,000$, $v = 39$, or $v^2 = 1519{\cdot}2$; so that

$$1519{\cdot}2 = \frac{2 \times 31,298,800,000}{481,737,000} - \frac{2 \times 29,870,000}{43,000} + C$$

$$= 129{\cdot}9 - 1389{\cdot}3 + C$$

or $C = 2778{\cdot}6$

Now substitute this value of C in the above equation, putting x = sun's radius = 430,000, and we have

$$v^2 = \frac{2 \times 31,298,800,000}{430,000} - \frac{2 \times 29,870,000}{481,350,000} + 2778{\cdot}6$$

$$= 145576 - 0{\cdot}1 + 2778{\cdot}6$$

$$= 148,354{\cdot}5$$

or v = 385 miles per second.

Thus the velocity at the sun's surface is increased by only $3\frac{1}{4}$ miles per second ($385 - 381\frac{1}{4}$), in the supposed case, viz., where the body starts from Jupiter towards the sun with the same velocity which it had acquired when it reached the surface of Jupiter, coming from rest at an infinite distance under the combined influence of Jupiter and the sun. We can easily see why, in this case, Jupiter imparts a greater velocity to the approaching body, than he withdraws as the body is receding. For the body's sun-imparted velocity is less before Jupiter is reached than after Jupiter is passed, and the less the velocity of the body the longer time is it under Jupiter's influence, and the greater therefore the resulting change of velocity. Thus the increment of velocity is somewhat greater than the decrement.

Be it now noticed that in every case in which a meteorite coming in from outer space passes close to Jupiter, there will be an acceleration of the meteorite followed by a retardation, or a retardation followed by an acceleration, and only the balance of effect is to be regarded as the permanent acceleration or retardation of the meteorite. The above investigation shows that the total increment of velocity ($27\frac{3}{4}$ miles per second) in a case manifestly giving a result beyond the maximum possible increment, is much less than the total velocity which Jupiter can impart in a body approaching him from an infinite distance under his own attraction only. And we see further that the velocity subsequently withdrawn is almost as great as the velocity thus added. It will be obvious, without independent investigation, that in the case of a meteorite which does not come within a considerable distance of Jupiter's surface, the velocity added or abstracted by Jupiter will be much less, as will also be the velocity abstracted or added, and consequently the balance of velocity whether added or abstracted.

Thus, suppose we want to determine the velocity of a body approaching, as in the case illustrated by Fig. 3, when at a distance of 4 radii of Jupiter, from Jupiter's surface. We get, obviously, instead of equation a above,

$$v^2 = 129{\cdot}9 + \tfrac{1}{4}\,(1389{\cdot}3) = 477{\cdot}2$$

or $v = 21{\cdot}8$

this is an increment of 10·4 miles per second (21·8 − 11·4) on the velocity which the sun's attraction alone would have imparted. The velocity subsequently abstracted would be nearly as great; and the balance of increase, therefore, relatively small. So, also, the balance of decrease, even in the case of so near an approach to Jupiter as this, would be small. And the chance of a meteorite coming so near as this to Jupiter would be almost inconceivably small; while the change of velocity under the actual conditions would be in reality much less than in the imaginary case here dealt

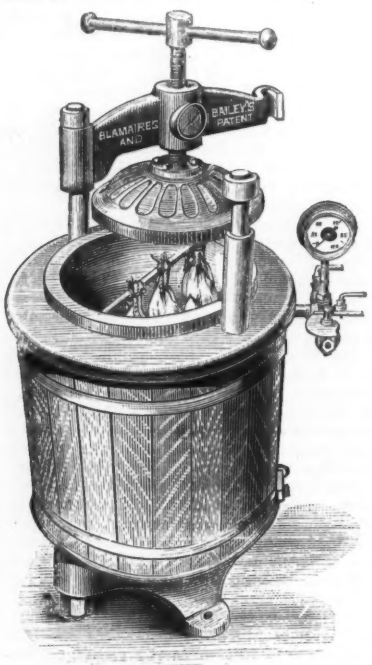
with, where the greatest possible difference of sun-imparted velocities in the approaching and subsequently-retreating meteorite have been imagined.

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE *being a popular magazine*) *than is accorded by the most excellent trade journals.*

STEAM-COOKER.

[Patented 1884.]—This invention, by Messrs. W. H. Bailey & Co., of the Albion Works, Salford, consists of a wrought-iron vessel encased in an outer shell, between which steam is admitted at any pressure from about 40 lb. to 100 lb., the pressure in some degree regulating the time which is taken to roast the meat. A gauge is provided to indicate the pressure, each cooker being tested up to 200 lb. before delivery. The cooker is also connected to any cistern or town's main for condensing and cooling purposes. A cross-head and dish and a potato-steamer are provided with each cooker, few other utensils being necessary. Vessels of almost any kind may be placed within the apparatus. When the contents require inspection, or when sufficiently cooked, the steam is turned off, a small quantity of cold water turned on to condense such steam as remains, the lid unscrewed, and the contents examined. The accompanying illustration is a view of the cooker with the lid partly opened, showing the swivel arrangement and part of the interior.



The following are some of the special merits and purposes claimed for this invention:—

1. Retention of all the nutritious products and essences of meats, &c., while being cooked, escape being impossible.

2. No possibility of charring joints, &c., these being cooked in their own moisture, thus retaining all their excellence and soluble properties.

3. Soups, meat extracts, jellies, and vegetables are cooked without loss through evaporation.

4. Bone essences and marrows can be entirely extracted, leaving the bone in a calcined state.

5. Tough meats can be cooked so as to be fit for food by this apparatus.

6. Many nuisances incidental to cookery are entirely avoided.

The steam-cooker may be also employed for the purpose of making herb, bark, and root decoctions, and for medicinal purposes generally; also for softening substances and reducing them to their elementary conditions.

MUSIC-STAND.

[Patent No. 6,939, 1884.]—This invention, by Mr. Bennett, who has entrusted its production to Mr. A. Cary, of Newbury, Berks, is likely to prove very useful to itinerant musicians of all grades.

The stand is claimed to be the only one that does not require taking to pieces in order to reduce it to a convenient, portable size.

It is specially adapted for all classes of instrumentalists, for both out-door and in-door use, and appears to be the simplest, neatest, and most portable music-stand yet invented.

Fig. 1.

Fig. 2.

In Fig. 1 is an illustration of the stand when open. The desk is so constructed that a self-acting arrangement causes the connection between it and the pillar to be in the centre when open and at the top extremity when folded, the same arrangement also causing it to be at the proper angle to the pillar when open, but parallel to it when closed. The desk folds up into practically a bundle of wires, the pillar is telescopic, and the tripod or legs fold back on the pillar, a locking arrangement keeping them in the open position when required.

The following advantages are claimed for the stand. It is the only music-stand which can be folded small enough to be fixed in the lid of an ordinary violin case without taking to pieces, as shown in Fig. 2. All screws, bolts, nuts, and springs are dispensed with. It can be varied in height to suit all requirements, and is held firmly in the desired position by a new and powerful eccentric arrangement. All connecting-rods, guides, stays, sliding-collars, &c., being dispensed with, it has a neat and elegant appearance. It is made entirely of sheet metal and tubes; it is light, strong, and durable, and there is nothing to wear or get out of order.

Our Whist Column.

BY FIVE OF CLUBS.

THE following hand was played recently at New York, Y's hand being mine :—

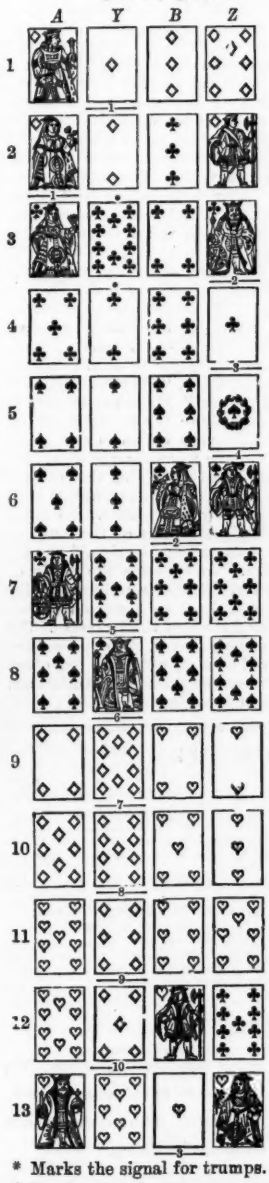
THE HANDS.

B { S. Q, 8, 6. / D. 3. } H. A, Kn, 6, 5, 4. / C. 7, 6, 4, 3.

Y { S. K, 9, 3, 2. / H. 8. / C. 10, 2. / D. A, 10, 9, 6, 5, 2. } Z { 10, Kn, A. S. / 2, 3, 7, Q. H. / 8, 9, K, A. C. / 7, Kn. D. }

A-B, 0. B. Tr. S. A. Z. Y-Z, 1. A leads.

A { S. 7, 4, 5. / D. K, Q, 8, 4. } H. K, 10, 9. / C. Q, Kn, 5.



* Marks the signal for trumps.

THE PLAY.

Card underlined takes the trick and card next below leads next.

1. *A* leads correctly from his longest suit. King is led in only two cases (as an original lead), viz., from Ace, King, and others, and from King, Queen, and others. *Y* holding six, and knowing *A* to hold probably four, and certainly three, sees that the suit will almost certainly be trumped next round. He therefore rightly captures the King. It is seldom good play to pass the King, however, even where there is no such risk of an early ruff.

2. *Y* having four trumps can safely force his partner (should it chance that *Z* has no Diamonds, *Y* could not at this stage lead trumps, his suit not being established; if *B* had been found with the Knave, *A* would have retained his Queen). But

3. As soon as Q has fallen, the time seems suitable for a signal. *Z* would not regard this as more than a suggestion, as *Y* had had a lead and had not led trumps. *A* rightly changes suit, and leads perhaps from the safest three-card suit, but he finds his partner with no strength in Clubs.

4. The signal is completed.

5. *Z* responds to the signal with his best trump.

6. And rightly leads next the highest of two, showing thereby that he has not more than one left. *Y*'s play of the small Spade is no finesse. He (that is, I), knew certainly that the Queen must lie with *B*. *Y* might have played King on the chance of drawing the Q. But the chance is small, as *Z* holds certainly but one of the remaining trumps. *Y*, however, is playing for something better—the chance, viz., of bringing in his long Diamonds.

7. *B* very properly forces *Y*. This is the sort of play that the Bumblepuppist abuses as giving a trick away; it is just the play to save the game here, if the game can be saved.

8. Unluckily for *A-B*, the trumps are evenly divided. *Y* draws the remaining trumps.

9. Brings in his long suit, and 10, 11, 12, 13. The rest of the game plays itself. *Y-Z* make four by cards (honours were not counted, which, it appears, is a customary arrangement in America).

CALCULATION OF CHANCES.—To give an idea of the opportunities which whist affords for scientific research, I make the following remarks on any play in the first round of the above game, noting in passing, that a player who lets his thoughts dwell on such matters in actual play is bound to play badly, just as a poker player who becomes scientific is bound to loose (so at least I am told, but I have never played poker). Supposing *A* to have led from four Diamonds, I holding six, then the chances are 7,464,702,960 out of 9,570,132,000 that the suit goes round once, and of course half of this that *Z*, my partner, holds two cards and *B* one card, half that *B* holds two and *Z* one. The chances are 2,105,429,040 out of 9,570,132,000, that the suit does not go round once: half of this that it is my partner who holds the other three of the suit. But these are only the chances on a certain assumption. Four other assumptions are possible, though less likely. First, my opponent, *A*, may have held four trumps, and three of each of the remaining suits, and so have been practically obliged to lead from a three-card suit; second, *A* may have led from five Diamonds; thirdly, from six; fourthly, though this of course is very unlikely, he may have held, so far as I know when I follow suit, all the seven remaining Diamonds. The chances of all four cases can be readily calculated, as also the chance in each case that the suit will go round once, or my partner or *A* hold the rest. But I apprehend that a player who should stop to make such calculations would not be beloved as a Whist player, however otherwise estimable he might be.

Our Chess Column.

BY MEPHISTO.

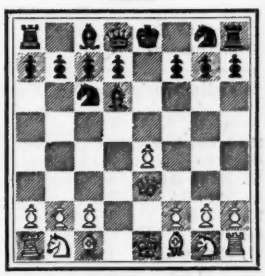
CENTRE GAMBIT.

THE moves given for White in the following variations have been tried by some of the strongest players of the Leeds Club, those for Black by Mr. Millard. As the latter were played entirely *sans voir*, Mr. M. thinks that they might in all probability be considerably strengthened. He claims no advantage for Black, but is of opinion that his unscientific-looking fourth move should lead to an equal game :—

CENTRE GAMBIT.

White.	Black.
1. P to K4	P to K4
2. P to Q4	P × P
3. Q × P	Kt to QB3
4. Q to K3	B to Q3

BLACK.



WHITE.

if 5.	KKt to B3 (*a*)	KKt to B3
	6. P to K5	Castles
(*a*)		
	5. P to KB4 (*b*)	Q to R5 (ch)

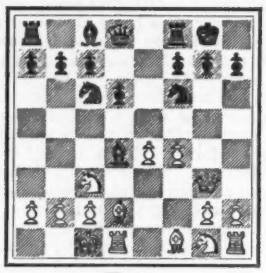
White.	Black.
6. P to KKt3	Q to K2
7. B to Q3	B to B4
8. Q to KB3	Kt to KB3
(*b*)	
5. QKt to B3 (*c*)	B to K4
6. P to KB4	QKt to Kt5
7. B to Q3	Q to R5 (ch)
8. P to KKt3	B × Kt (ch)
9. P × B	Kt × B (ch)
10. P × Kt	Q to KB3
(*c*)	
5. QKt to B3 (*d*)	B to K4
6. B to Q2	KKt to B3
7. P to KB4	B to Q5
8. Q to KKt3	P to Q4
9. P × P	QKt to Kt5
(*d*)	
5. QKt to B3	B to K4
6. B to Q2	KKt to B3
7. Castles	Castles
8. P to KB4	B to Q5
9. Q to KKt3	P to Q3
10. P to KB5	B to K4
11. Q to KKt5	B to Q2

J. W.

[Any original suggestion in the conduct of the attack or defence of an opening will always command our fullest attention. The defence given above, as practised by "Mr. Millard against some of the strongest members of the Leeds Chess Club," is certainly original; at the same time it runs contrary to "first principles," and, therefore, cannot possibly be good. That which is wrong is not less certainly so because it is indulged in from want of knowledge or perception. Chess players ought to follow the example of the common mason, whose procedure contains the quintessence of all philosophy. He lays every single stone or brick straight and

true to each other, and the fabric takes care of itself. No game can prosper as well as it might when the KB is played to Q3 blocking the QB. No doubt in some of the above variations Black seemingly holds his own well, but White has himself begun by disregarding the "first principles." In KNOWLEDGE, p. 249, we said: "If Black succeeds in bringing out his pieces, then the moves of the Queen will virtually be transformed into loss of time for White." But Black ought not to succeed in bringing out his pieces well. Thus in the first variation, after 5. KKt to B3, Kt to B3, White need not play 6. P to K5, but might content himself with playing a waiting move, such as 6. B to Q3, and sooner or later Black will be compelled to move his KB again. Again, in variation (*d*) the aspect of the game ought to be different with proper play, *i.e.*, 5. QKt to B3, B to K4. 6. B to Q2, Kt to B3. 7. Castles,

BLACK.



WHITE.

Castles. 8. P to B4, B to Q5. 9. Q to Kt3, P to Q3. In this position we certainly would not play 10. P to B5, but would continue with 10. Kt to B3, and we do not see how Black will be able to meet the coming pressure of White's attack on the K's side.

If	10. Kt to B3	Kt to KR4
	11. Q to K sq.	B × Kt
	12. B × B	Kt × P
	13. Q to Kt3	Kt to Kt3
	14. P to KR4	

Besides this, it is to be considered whether White would not do equally well by play 9. Q to K sq. In any case, White's development must be superior to Black's.]

SOLUTIONS.

PROBLEM 154.

1. Kt to B7	K to Q5	or	1.		K × P
2. Kt to B6 (ch)	K to B5		2. Kt to K8 (ch)		K to K4
3. Q to B sq.	Mate		3. Q to K3		Mate
	if 2. K to K5			if 2.	K to K3
3. Q to B3	Mate		3. Q to Q6		Mate

PROBLEM No. 155.

1. B to R8	P to Kt3	or 1.		Kt to Q3
2. Q to Kt7	Any	2. Q to Kt6		Any
3. Q mates		3. Q mates		

ONE of twenty games played simultaneously at the North London Chess Club:—

White. Mr. J. Gunsberg.	Black. Mr. W. F. Flear.	White. Mr. J. Gunsberg.	Black. Mr. W. F. Flear.
1. P to K4	P to K4	12. B to Kt3	R to KB sq (*e*)
2. Kt to QB3	Kt to QB3	13. Kt to R4	B to B2
3. B to Kt5	Kt to Q5	14. P to Q4	P × P
4. B to R4	B to B4	15. Q × B	P × B
5. Kt to KB3	Kt × Kt (*a*)	16. P × P	Q to K4 (*f*)
6. Q × Kt	Q to B3	17. R to Q6	P to B3
7. Q to Kt3	P to B3 (*b*)	18. R to B5	Q × KP
8. P to Q3	Kt to K2	19. R to KB sq.	P to Kt3
9. B to K3	B to Kt3	20. KR to Q sq.	Kt to K4 (*g*)
10. Castles (QR)	Kt to Kt3	21. R to K6 (ch)	Resigns
11. KR to KB sq. (*c*)	P to KR3 (*d*)		

(*a*) This exchange is forced, as the KP cannot be defended without loss of time.

(*b*) Necessary, to prevent Kt to Q5, also to liberate the QP.

(*c*) With a view to the possible advance of the KBP.

(*d*) If P to Q3, White replies B to Kt3, threatening to win the Queen by B to Kt5, so that in any case P to KR3 was judicious.

(*e*) P to Q3 followed by B to K3 and Castles (QR) seems a more promising line of play.

(*f*) Probably the best move, for the exchange of Queens would give him the best game.

(*g*) Overlooking White's pretty combination, which he might have prevented by Q to K2. White would, however, retain a good attack.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

RAVENSHOE.—Solutions correct.

SQUIRE.—1. Q to B5 does not solve 156.

J. MCKEAN.—Problem received with thanks.

SCIENCE AND RELIGION.—I have sometimes a feeling that the student of science *ought* to be exasperated, if anything so foolish could exasperate, at the contempt of God and the insult to God implied by attacks made upon science in the name of religion. Of course the utter inanity and stupidity of some of those attacks justify science in regarding them very carelessly. When science is told, for instance, that to admit evolution on the ever-widening scale now required is "setting on one side the Almighty in the name of universal evolution," it suffices to smile at the absurdity. An insect who should say that, "Believing a tree to have grown is setting on one side the Almighty in the name of growth," would present a no more preposterous picture than the narrow trained person who is appalled at the thought that a planet has been developed or that a race of animals is the product of evolution. A winged insect rejecting with disdain the idea of kinship with the grub of its own race would not be more absurd than the man who shudders at the suggestion that his remote ancestors were savages or *their* remote ancestors akin to the remote ancestors of animals yet lower in the scale of being. As one might answer the foolish insect, "The leaf has grown in your knowledge; did God, then, think you, make the tree, and did He not also make the leaf?" so may the opponents of evolution be answered, "The tree and the animal grow, to our knowledge; did God, then, make the solar system, and did He not also make the tree?" "Did He make the species of animals, and did He not also make the individual animal?" If the common objection to evolution has any weight, it must be because those who urge it do not consider tree or animal God's work, knowing that the tree and the animal have grown. They put their intelligence on Topsy's level. Their answer to the question, "Who made you?" should be not "God," but "'Spects I growed." If the known growth of the individual man leads no one above the capacity of an infant negro to say that *therefore* the individual man is not God's work, on what imaginable grounds can the scientific theory of the growth of a solar system be interpreted as signifying that science regards the sun and moon and stars as not God's handiwork? All such objections as these are worthy only of ridicule. So soon, however, as the rabid religionist irreligiously talks of the study of the book of nature as worthless, or as dangerous, he should be met not by ridicule, but by stern rebuke. To contemn the study of God's works is to despise the Almighty. To fear lest closer inquiry into the laws of the universe should lead to thoughts either dangerous or injurious is to insult the Author of the Universe. The attacks of the ungodly enemies of science, that is, the opponents of the study of God's Great Book, should be met, *not* as is too often done by veiled apologies, but by stern and outspoken denunciations. —R. A. PROCTOR in *Newcastle Weekly Chronicle*.

CONTENTS OF No. 184.

	PAGE		PAGE
The Kalevala. VI. By Edward Clodd	383	George Eliot on Old Age	391
Our Household Insects. (*Illus.*) By E. A. Butler	384	The Electric Light at the Inventions Exhibitions	393
Meteors and Falling Stars. By R. A. Proctor	386	Editorial Gossip	396
The Workshop at Home. (*Illus.*) By a Working Man	386	Reviews:— Some Books on Our Table	396
Evolution of the Sense of Beauty. By Constance C. W. Naden	387	Face of the Sky. By F.R.A.S.	398
The Cocoon of a Spider	389	Correspondence: Wave Measurement — The Ruddy Eclipsed Moon—Effect of Colour Upon Temperament, &c.	398
Chapters on Modern Domestic Economy	389	Our Inventors' Column	402
The Origin and Home of the Diamond. By W. J. Harrison	390	Our Mathematical Column	403
		Our Chess Column	404

NOTICES.

Part XLII. (April, 1885), now ready, price 1s., post-free, 1s. 3d.

Volume VI., comprising the numbers published from July to December, 1884, is now ready, price 9s.

Binding Cases for all the Volumes published are to be had, price 2s. each including parcel postage, 2s. 3d.

Subscribers' numbers bound (including title, index, and case) for 3s. each Volume; including return journey per parcels post, 3s. 9d.

Remittances should in every case accompany parcels for binding.

OFFICE: 74-76, GREAT QUEEN STREET, LONDON, W.C.